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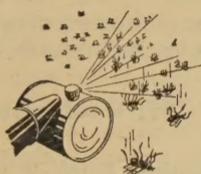
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**Service and Regulatory Announcements, January-December 1946.—S.R.A.,
B.E.P.Q. no. 166, 117 pp. Washington, D.C., U.S. Dep. Agric., 1947.**

Announcements relating to domestic quarantine (Quarantine no. 52) against the pink bollworm [*Platynedra gossypiella*, Saund.] in the United States include Administrative Instructions (B.E.P.Q. 558) (pp. 20-21) authorising the movement interstate of cottonseed originating in a heavily infested area, provided that in addition to the heat treatment in the process of ginning [R.A.E., A 33 286], it is subjected either to a further heat treatment in a separate apparatus or to fumigation with methyl bromide. In the second heat treatment, the mass temperature of the seed must be raised to at least 155°F. during an exposure period of two minutes. The exposure period is the time required for the seed to travel from the point of entrance into the heater to the point where the temperature reading is taken beyond the exit of the heater. The apparatus must be so constructed as to apply an adequate amount of live steam to the seed promptly upon entrance, and radiated heat for the full length of the heating unit, and to assure a constant and uniform flow of cottonseed through it, and it must have devices that will stir the seed so as to expose each seed to both the introduced steam and radiated heat during the entire exposure period. Fumigation with methyl bromide must be carried out at a rate of 3 lb. per 1,000 cu. ft. for 24 hours in a chamber lined with sheet metal, with all openings fitted tightly against a double row of moulded sponge rubber gasketing, and a combination circulating and venting system where the capacity is greater than 100 cu. ft. and a circulating fan where it is less. All chambers must pass a pressure test whereby the time lapse is more than 22 seconds for an internal pressure of 50 mm. on a kerosene-filled open arm manometer to recede to 5 mm. The seed must be placed in sacks on a rack allowing the air to circulate beneath it and its temperature at the beginning of the treatment must be at least 60°F.; a circulating fan must be operated for at least 30 minutes after the introduction of the fumigant. The germination of cotton seed treated in this manner was found to be satisfactory in limited tests.

Other information includes digests of plant-quarantine import restrictions in British Honduras, Mozambique and Newfoundland, revised digests of restrictions in Bolivia, Jamaica, Egypt, the Soviet Union, Nyasaland, Peru, Venezuela and French Morocco, supplements to restrictions already noticed in Cuba [30 389], Mexico [25 286] and South Africa [26 691], a revised supplement to restrictions already noticed in Uruguay [30 175], and summaries of the current domestic and foreign plant quarantines applying to the continental United States and the Territories of Porto Rico and Hawaii, and of other restrictive orders under the Plant Quarantine Act [17 163].

LHOSTE (J.). Ce qu'il faut savoir des maladies des plantes cultivées et de leurs ennemis. La pratique des soins à donner au potager, au verger, aux grandes cultures. Tome I A-D. Tome II E-Z.—Savoir en -ist. nat. 19-20 pp. 1-368 [2+] 369-764, 8 col. pls., 206 figs, 57 refs. Paris, P. Lechevalier, 1947.

This encyclopaedia of animal and vegetable pests of plants and their control relates very largely to conditions in France, but some information on neighbouring regions is included. The matter is presented under the crop plants, control agents and the more important and general pests and diseases, arranged alphabetically. Specific pests are dealt with under the plants they attack; in the case of insects, information is given on their appearance, distribution, the damage caused by them, and control. The introductory chapters contain discussions on methods of pest control, research methods employed in laboratory and field investigations on insecticides and fungicides, on structure of chemicals

in relation to their insecticidal action, the physical properties of spray and dust materials and their importance in determining effectiveness, various types of equipment for applying sprays and dusts, and the symptoms produced by materials used in control that are toxic to man, with the precautions to be adopted during their use and the appropriate antidotes.

JENKINS (C. F. H.). **Codlin Moth in Western Australia.**—*J. Dep. Agric. W. Aust.* (2) **24** no. 1 pp. 42–46, 4 figs. Perth, W.A., 1947.

An outbreak of the codling moth [*Cydia pomonella*, L.], was discovered on apple in a small orchard at Collie, Western Australia, in March 1947, and the 13 previous outbreaks in that State since 1903–4 are shown in a list [*cf. R.A.E.*, A **16** 549; **23** 396]; the last was in 1937–39. The fact that these were successfully eradicated has led to the belief that the State is unsuitable for the establishment of *C. pomonella*, and it has also been suggested that certain outbreaks were recrudescences of earlier infestations. Periods of 5 and 10 years elapsed between the three outbreaks, of which the first was severe, that have occurred at Collie, and it is unlikely that the pest could have remained unnoticed for so long. Ways in which *C. pomonella* can be introduced into the State are briefly discussed, and the importance of the prompt notification of the presence of any unfamiliar, injurious insect emphasised.

KEVAN (D. K. McE.). **The Eucalyptus Weevil in East Africa.**—*E. Afr. agric. J.* **12** no. 1 pp. 40–44, 13 refs. Nairobi, 1946.

Gonipterus scutellatus, Gylh., was found injuring *Eucalyptus globulus* over large areas at Kericho, in November 1944, and was subsequently observed in several other places in Kenya and also in eastern Uganda. It had apparently been present in Kenya for some years and had presumably been introduced from South Africa by air at Kisumu. The author gives short accounts of the appearance of the egg, larva and adult of the weevil and of its life-history, the damage it causes, and its distribution in Kenya and eastern Uganda. Breeding is apparently continuous throughout the year in Kenya. *E. globulus*, *E. maideni*, *E. robusta* and *E. smithii* are the most important susceptible species of *Eucalyptus* grown there; others, including *E. saligna*, are only slightly attacked, and many, including *E. citriodora*, are apparently immune. The adults injure the leaves and soft bark of young shoots, and the larvae cause more serious damage to the leaves, with the result that the trees become stunted and may split and die.

The Mymarid, *Anaphoidea nitens*, Gir., which parasitises the eggs [*cf. R.A.E.*, A **32** 355], was introduced from South Africa and liberated in several localities in Kenya in March 1945, and after stocks had been bred in the laboratory, in August, September and November. It had become well established in the Kericho area by May, and was found in October at one or more places in each of the four areas in which it had been released by then. It had spread for several miles in some places and was parasitising high percentages of the egg of the weevil. Its life-cycle, which lasted 19–33 days, with an average of about 21 in the laboratory, is briefly described. Stocks for liberation were bred by exposing egg-capsules on leaves collected in the field or from specially grown susceptible seedlings to adult parasites in tubes, on the side of which a drop of honey and water was smeared. The adults were given fresh capsules daily for 15 days. The newly emerged adults were distributed in tubes. Following the establishment of the parasites, laboratory rearing proved unnecessary.

KROGH (P. M. D.) & TOOKE (F. G. C.). **Pentachlorophenol Solutions for the Preservation of Wood.**—[9] pp., 2 refs. [Pretoria, Dep. Agric. For. S. Afr., ? 1946.]

In view of the discovery of *Hylotrupes bajulus*, L., and *Anobium punctatum*, Deg., and the great increase of damage by *Lyctus brunneus*, Steph., in South Africa [cf. *R.A.E.*, A 34 12], the high toxicity of pentachlorophenol to insects and its successful use in fuel oil as a wood-preserved against them [cf. 31 318; 32 336, 345, etc.], tests were carried out with this compound in South Africa.

Initial tests in 1942 showed that fuel-oil solutions spoilt the appearance of the treated wood and also failed generally to penetrate woodwork deeply enough to kill larvae of *Hylotrupes* or *Lyctus*. Extraction and medium and heavy solvent naphthas were therefore tested as solvents in 1943. They all dissolved up to 10 per cent. by weight of pentachlorophenol and possessed very high penetrating power. When three-inch boards of *Terminalia superba*, heavily infested with *Lyctus*, were brushed over once with a 5 per cent. solution of pentachlorophenol, borer activity ceased immediately and it did not begin again during the two years that elapsed to the time of writing; no living larvae were found in the treated wood. By this treatment, penetrations of $\frac{1}{8}$ – $\frac{3}{4}$ in. were effected in both radial and tangential directions, and all galleries to a depth of two inches below the surface were thoroughly permeated. Brush treatment of locally grown pine timber resulted in penetration of $1\frac{1}{2}$ ins. Although these solutions readily penetrate wood without staining it and the solvents evaporate rapidly, they are highly inflammable and give off fumes that are harmful in confined spaces, and heavy solvent naphtha has a lasting and disagreeable odour. Extraction and medium solvent naphtha, however, can be used in the open or in well ventilated rooms and where there is not much risk of fire. Further investigations made to find a solvent with a higher flash point, lower toxicity to man and penetrating properties at least as good showed that white spirit (a petroleum naphtha) dissolved only about 1 per cent. pentachlorophenol, but penetrated wood as readily as the coal-tar naphthas, was volatile but much less inflammable and gave off no noxious fumes. Linseed oil, seal oil and sostroil (dehydrated castor oil) were found to be good solvents of pentachlorophenol, to blend with white spirit and to dry quickly, and dipping for one minute in a cold mixture of pentachlorophenol, linseed oil and white spirit (3.85 : 21.15 : 75) gave adequate penetration of wood of certain conifers, including six species of pine grown in South Africa; mixtures of pentachlorophenol, seal oil and white spirit (4 : 20 : 76) and of pentachlorophenol, sostroil and white spirit (4 : 16 : 80) were equally effective. After immersion for two minutes at a temperature of 90°F., little or no penetration was obtained in comparative tests with water and only fair penetration with fuel oil and creosote. Comparable results were not always obtained with the same species of wood from different localities, and dipping for two minutes did not always result in deeper penetration than dipping for one minute.

The solutions, particularly the one containing sostroil, have been used extensively in treating woodwork infested with *Lyctus* in houses, with excellent results. In a few cases, borer activity continued for 3–4 weeks after treatment and then suddenly stopped, but in most cases all activity ceased immediately after treatment. The effect of the solutions on the amenability of wood to gluing was not determined, but tests have shown that their effect on finished joinery and glued material is of no consequence. The possibility of using pentachlorophenol in fuel oil or mixtures of a solution in Tarrakan diesel oil with creosote (20 : 80 or 40 : 60) to protect wooden telephone and power-transmission poles against both insect attack and weathering, possible methods of treating hardwoods, costs and danger of fire are discussed. Data on the toxicity of pentachlorophenol to laboratory animals and its effects on man are quoted from

an American paper; it is concluded from them that it is not a cumulative poison, but that the precautions suggested by the manufacturers should be followed until further toxicological information is available.

JANNONE (G.). **Prima nota sulla cascota dei frutti di agrumi dovuta a insetti in Eritrea.** [First Note on the Fall of *Citrus* Fruits caused by Insects in Eritrea.]—*Boll. Comm. Eritrea* 1 no. 24, 2 no. 1 repr. 7 pp. Asmara, 1945-46.

Seconda nota. . . . Second Note. . .]—*Op. cit.* 2 nos. 9-11 repr. 9 pp., 1 pl. 1946. (With a Summary in English.)

These two papers contain notes on the bionomics and control of *Argyroploce leucotreta*, Meyr., *Ceratitis capitata*, Wied., and *Dacus ciliatus*, Lw. (*brevistylus*, Bez.) in Eritrea, where they are the principal cause of the fall of ripening fruits of sweet and mandarin oranges and sometimes also of bitter oranges and grape-fruit. The insects had not been identified when the first paper was written, and *C. capitata* had not previously been recorded from Eritrea. The total loss due to fruit-fall ranged up to 15 per cent. in 1944-45, according to district, and of this the three insects caused about 35, 45 and 5 per cent., respectively. Fallen fruits that were infested usually contained only one larva of *A. leucotreta*, but up to 13 of *C. capitata* were sometimes present. The geographical distribution and food-plants of all three are reviewed from the literature; *D. ciliatus* was previously known in Eritrea as a pest of cultivated cucurbits, and was discovered attacking *Citrus* chiefly in the highlands, whereas the other two pests were most injurious in the plains.

The first paper also contains a review of measures that have been employed against fruit-flies in other countries and might be of value against *Argyroploce* as well as the two fruit-flies in Eritrea, and a suggestion for the planting of cucurbits as a trap-crop against *D. ciliatus*.

Insect Pests.—*Agric. Gaz. N.S.W.* 58 pt. 4 pp. 197-200, 3 figs. ; pt. 6 pp. 305-309, 9 figs. Sydney, 1947.

The first of these two parts of a series on insects in New South Wales [cf. *R.A.E.*, A 36 73] contains notes on the bionomics and control of *Rhoecocoris sulciventris*, Stål, a serious pest of *Citrus*, chiefly on the north coast [cf. 33 267; 34 383]. It is also stated that *Leptocoris lurida*, Dallas, a Coreid that is widely distributed in Australia and usually develops among native plants, was common in dwellings and sheds in the season of 1946-47. It appears to thrive in hot, dry conditions and occurs in dense swarms on fallen timber, tree stumps and fence posts, from which the bugs enter buildings. They have also been recorded as feeding on various garden plants and on cultivated fruits such as figs [cf. 23 399], peaches and apricots. They have been controlled in buildings by spraying with 0.1 per cent. DDT in an emulsified solution, which should also prove effective on plants.

The insects discussed in the second part include the Pentatomids, *Oechalia consocialis*, Boisd., and *Cermatulus nasalis*, Westw., the nymphs and adults of both of which are predacious. *Oechalia* feeds on Lepidopterous larvae, notably *Phalaenoides glycinae*, Lewin, on grape-vines [cf. 26 111], and *Cermatulus* on larvae of *P. glycinae*, the cherry sawfly, *Caliroa limacina*, Retz. [cf. 20 46], and the fig-leaf beetle, *Galerucella (Galeruca) semipullata*, Clark.

OLALQUIAGA FAURÉ (G.). **Apostillas al conocimiento de las langostas.** [Notes on Acridids.]—*Simiente* 16 no. 1 pp. 6-15, 9 figs., 7 refs. Santiago de Chile, 1946.

In the summer of 1945-46, Acridids were very injurious in three districts in central Chile to the south of Valparaiso. The species involved were *Dichroplus maculipennis*, Blanch., *D. vittiger*, Blanch., *D. elongatus*, G.-T., *Schistocerca*

cancellata, Serv., *Scyllina signatipennis*, Blanch., and *Trimerotropis ochraceipennis*, Blanch., of which the first three are the most injurious to crops [cf. R.A.E., A 35 19, 354], attacking cereals, potatoes, tomatoes, lucerne, grape-vines and many other fruits and vegetables. Pumpkin and certain wild plants appeared to be avoided. *T. ochraceipennis* was found only among wild grasses and brushwood, but it impoverishes pastures and possibly causes soil erosion. The cost of the damage done in the three districts is estimated, and a short account is given of the bionomics of the grasshoppers, which were similar for all the species. Winter is passed in the egg stage; females of the summer generation, which is the most harmful, continue to oviposit from midsummer until autumn, and some of their eggs hatch the same season, while others do not hatch until the following spring. Females of *D. maculipennis* and *D. vittiger* in captivity oviposited in late January and throughout February; up to 22 eggs were found in the egg-pods of *D. maculipennis*. Grasshoppers of this species observed in the field in Casablanca started to feed at 8 a.m. in fine weather; during the heat of the day they sheltered among the foliage and at 5 p.m. they began to leave the ground to congregate on fences, bushes and tall plants, where they passed the night. They traversed short distances in small swarms. Examples of *D. maculipennis* and *D. vittiger* attacked their companions in both field and laboratory, and some were parasitised by the larvae of an unidentified fly [cf. 35 20]. These two species and *S. signatipennis* were frequently found caught in the webs of the spider, *Latrodectus mactans*, F., and numerous grasshoppers were destroyed by birds.

From meteorological data, the author concludes that wet weather favours oviposition, and when this is followed by dry weather during the incubation period, an outbreak is likely to result. Dry weather that destroys the vegetation kills many grasshoppers. The usual control measures are discussed; a poison bait of 3 lb. Paris green, 100 lb. bran and 10 gals. water gave satisfactory results, and DDT at 5 per cent. in a dust or in a kerosene spray caused considerable mortality when applied during the day to the bushes, etc., on which the grasshoppers settled at night.

BLANCHARD (E. E.). **Seis nuevos Campopleginos argentinos (Hym. Ichneumonidae).** [Six new Campopleginae from Argentina.]—*Acta zool. lilloana* 3 (1946) pt. 2 pp. 289–305, 6 figs. Tucumán, 1947. (With a Summary in English.)

In addition to one without a host record, the new Ichneumonids described are *Nemeritis (Idechthis) pastranai* reared from *Rhyacionia buoliana*, Schiff., *Notamorphota* (gen. n.) *timocraticae* from *Timocratica haywardi*, Busck, *Campoplex haywardi* from *Gnorimoschema operculella*, Zell., and *Amelocotonus christensenii* and *Sagaritopsis (Sagaritis) grioti* both from *Thyreion gelotopoeon*, Dyar.

COMPÈRE (H.). **A new Genus and Species, *Eurymyiocnema aphelinoides* (Hymenoptera, Aphelinidae), and a History of the Genera *Euryischia* Riley and *Myiocnema* Ashmead.**—*Bull. ent. Res.* 38 pt. 3 pp. 381–388, 4 figs., 14 refs. London, 1947.

Eurymyiocnema aphelinoides, gen. et sp. n., is described from adults of both sexes reared from mummies of *Pseudococcus* inhabited by *Leptomastix* in Uganda and from mummies of *P. lepelleyi*, Betrem, in Java. The literature on the two closely allied genera, *Euryischia* and *Myiocnema*, is reviewed, showing that opinions vary as to whether they are Elasmids or Aphelinids, but the view is here expressed that all three genera are Aphelinids. So far as is known, the species are all hyperparasites; those of *Euryischia* were reared from the puparia of parasitic Diptera, and those of *Myiocnema* and *Eurymyiocnema* from parasites of scale insects and mealybugs, respectively.

MANI (M. S.). **Some new and imperfectly known Gall Midges (Itonididae : Diptera) from India.**—*Bull. ent. Res.* **38** pt. 3 pp. 439-448, 20 figs., 9 refs. London, 1947.

The author gives an annotated list of seven species of gall-midges from India, including three new ones, which are described. The latter include *Asphondylia ricini*, which is sporadically of importance as a pest of castor (*Ricinus communis*) in Hyderabad, and *Amradiplosis* (gen. n.) *echinogalliperda*, which causes galls on the leaves of mango (*Mangifera indica*) and has been found in the United Provinces and at Calcutta. A. S. Rao states that larvae of *Asphondylia ricini* attack the male flowers, preventing them from opening, and the capsules, which become deformed and fall prematurely; four or five larvae occur in each infested capsule, and extensive crop failure is sometimes caused. The eggs have not been found, but are presumably deposited in the young buds. The larvae pupate within the damaged plant parts, and are parasitised by *Bracon* sp. and *Eurytoma* sp.; the latter may be a hyperparasite.

STRICKLAND (A. H.). **Coccids attacking Cacao (*Theobroma cacao*, L.), in West Africa, with Descriptions of five new Species.**—*Bull. ent. Res.* **38** pt. 3 pp. 497-523, 36 figs., 2 pp. refs. London, 1947.

In view of the serious threat to the cacao industry in the Gold Coast and Nigeria presented by the swollen-shoot virus disease [cf. *R.A.E.*, A **35** 88], which is transmitted by at least three species of mealybugs [34 102], an investigation of the bionomics and distribution of cacao-feeding Coccids throughout the equatorial forest belt that comprises the most important cacao-growing area in West Africa appeared desirable. The author here gives an annotated list of 44 such Coccids, based on a year's intensive collection in the Eastern Province of the Gold Coast, collections made by other workers, and records in the literature of species from west and central Africa and the Island of San Thomé, together with a further list of 17 species recorded from cacao elsewhere. Five new species from the Eastern Province are described. They comprise *Coccidella spelaea*, which was collected from the roots; *Tylococcus westwoodi*, of which a small colony was found on a pod and which is probably not of economic importance; *Formicococcus tafoensis*, which feeds in cracks or under flakes of bark, usually on buttress roots or within eight feet of the ground, and was collected from cacao, on which it was found twice, and from *Ceiba pentandra*, *Terminalia superba*, *Cola cordifolia*, *Alstonia congensis*, *Guarea cedrata*, *Triplochiton scleroxylon* and *Casuarina equisetifolia*; *Farinococcus loranthi*, which occurs on *Loranthus* growing on cacao, coffee and several indigenous trees and was once found on a cacao pod; and *Newsteadia wacri*, which occurred in very large numbers on the buttress roots of *Terminalia superba* and *Triplochiton scleroxylon*, and was found feeding on the bole of a young cacao tree and on a rootlet.

Pseudococcus citri, Risso, is believed by Box [who refers to them by numbers] to be the vector of strains C and D of the swollen-shoot virus complex [34 102], and Posnette states in correspondence that it has transmitted strain F under experimental conditions. It is widely distributed throughout the cacao belt, especially in Nigeria, and was collected from the Eastern Province and Ashanti, in the Gold Coast, and from British Togoland. A list of 53 plants, excluding cacao, on which it has been found in the Gold Coast is given; 20 species of ants have been taken in association with it. *P. njalensis*, Laing, is the commonest cacao mealybug in the Gold Coast, and is almost certainly the chief natural vector of the virulent strain A of the virus complex [*loc. cit.*]. It is invariably tended by ants in the field, and nearly 50 species have been recorded in association with it. Although the ants protect the mealybugs from weather by making carton tents over them, transport them from felled to living trees and keep them free

from the grey mould (a mixture of species in which an *Aspergillus* predominates) that develops on them when their honey-dew is not removed, some of the ants also feed on the immature Coccids, and in a laboratory experiment, mealybugs on cacao seedlings from which ants were excluded were considerably more numerous after a period of six months, though covered with mould, than those on seedlings on which the initial infestation had been equal but to which the ants had access. *P. njalensis* is parasitised by *Neodiscodes martinii*, Comp., another Hymenopterous parasite tentatively determined as *Cheiloneurus* sp., and a Cecidomyiid that is also the commonest parasite of *P. citri* in the Gold Coast and attacks up to 12 per cent. of *P. njalensis*. The Cecidomyiid larvae feed on the body fluids of the Coccids, and pupate beneath their dead hosts; parasitised female Coccids sometimes lay some eggs before dying. The larvae of two Lepidoptera, at least one Coccinellid and a Staphylinid prey on *P. njalensis* and are apparently not molested by the ants. A list is given of upwards of 60 food-plants of this mealybug, supplementing one already noticed [34 46]. *Ferrisia virgata*, Ckll., is less common than *P. njalensis* and is therefore of less importance as a vector of strain A [34 102]. It appears to be rare in most bush cacao farms, but common where there are introduced ornamental plants, especially in dry areas. It also colonises bushes along main roads, and its spread appears to have coincided with that of certain introduced plants, notably *Acalypha* spp. and *Leucaena glauca*. Lists are given of some 40 plants on which it feeds in the Gold Coast and of six on which it became well established under experimental conditions. It is not generally attended by ants, though two species have been observed in association with it, and is commonly parasitised by *N. martinii*.

VAN DE POL (P. H.) & BESEMER (A. F. H.). **De bepaling van de eidoedende werking van winterbestrijdingsmiddelen in het laboratorium. Eerste deel.** [Laboratory Tests of the ovicidal Action of Winter Sprays. First Part.]—*Tijdschr. PlZiekt.* **52** pt. 1 pp. 1-17, 2 pls., 4 graphs, 9 refs. Wageningen, 1946. (With Summaries in French and English.)

In the winter of 1943-44, laboratory tests were carried out in Holland to determine the ovicidal value of various preparations containing dinitro-ortho-cresol or salts of it, which are being used in place of tar distillates (fruit-tree carbolineums) for winter spraying of fruit-trees, and in this paper are given the results of tests on eggs of *Aphis (Doralis) pomi*, Deg. Mortality was ascertained by microscopic examination, dead eggs being distinguished by coagulation and other changes in the contents [cf. *R.A.E.*, A **27** 236]. The dinitro-cresol preparations, which differed in strength, were diluted to contain about 0.25 per cent. dinitro-cresol whether as salt or free acid, and the tar-distillates ("normal" or "emulsified" carbolineums [cf. **35** 70]) were used at 6 per cent. Tests were carried out at fortnightly intervals from October to March, and within the same period, much weaker dilutions were also tested, at intervals of a month. Eggs of *A. pomi* on twigs were placed in test-tubes containing the liquids and shaken up for 30 seconds. They were then kept in dishes at 9-14°C. [48.2-57.2°F.] and a relative humidity of about 100 per cent. until examined for mortality. All liquids containing 0.25 per cent. dinitro-cresol killed all eggs in four days or less throughout the winter, whereas the percentages killed by tar distillate at 6 per cent. averaged only 18 from mid-November to mid-January, as compared with 78 from October to mid-November and 70 from mid-January to March. Lower concentrations of dinitro-cresol (0.025-0.0025 per cent.) did not give complete mortality, and the mortality declined very rapidly at concentrations of less than 0.025 per cent., but the eggs were still equally susceptible throughout the winter. No differences were observed in the effectiveness of the ammonium and sodium salts [cf. **33** 15], or in that of the other preparations tested, or in the pH of the liquids containing them

at concentrations that did not give complete mortality. Resistance to tar distillate increased as the concentration decreased from 6 to 1 per cent., and "emulsified" carbolineums were inferior to "normal" carbolineum. It is concluded that whereas sprays of dinitro-cresol could be applied at any time during the winter, tar distillates should not be applied before mid-January.

The effect of using dinitro-cresol with other spray materials is discussed; since it was shown in these tests and in those of other workers that an increase in the pH of a dinitro-cresol spray reduces its ovicidal action [cf. 33 15; 35 201], the addition of Bordeaux mixture or other materials that increase the alkalinity of the spray should be avoided. The addition of Gesarol [DDT] has no detrimental effect, but experience has shown that copper oxychloride sometimes reduces the effectiveness of the spray when applied late, though it has little effect on pH.

When eggs were kept outdoors and at 8-12 or 22°C. [46.4-53.6 or 71.6°F.] in the laboratory after treatment with dinitro-cresol preparations at the end of November or February, the rapidity with which they died increased with the temperature. Spraying should therefore be postponed until late March or early April, since, if the spray acts slowly, there is more time for its action to be affected by rain. No significant differences in mortality were observed when the temperature of the spray liquid was 22, 12 or 2°C. [35.6°F.].

To test the effect of rainfall on ovicidal action, eggs that had been treated with dinitro-cresol or tar-distillate sprays 23 hours, four hours or 30 minutes previously were immersed and agitated in water for 30 minutes. The mortality of the eggs that had been immersed 23 hours after treatment differed little from that of the controls, but immersion after the two shorter periods led to progressively larger decreases in mortality, and it is concluded that heavy rain within a few hours of spraying will reduce mortality, even if the spray has completely dried.

FRANSEN (J. J.), TERPSTRA (P.) & WESTENBERG (L.). **Draagstofproblemen.** [Problems of Carriers.]—*Tijdschr. PlZiekt.* **52** pt. 2 pp. 37-65, 1 fldg. pl., 8 refs. Wageningen, 1946. (With a Summary in English.)

An account is given of laboratory experiments on the effect of dolomite and other carriers on insecticidal dusts with which they are used for the control of forest insects in Holland [cf. R.A.E., A 34 88-89, etc.]. In 1937, it became necessary to find a carrier cheaper than talc, which had previously been used, and dolomite appeared promising until 1941, when mixtures of derris and dolomite, prepared in 1938, were far less toxic to larvae of the brown-tail moth, *Euproctis chrysorrhoea*, L., than derris in other carriers. In tests in 1941, freshly prepared dusts of derris, diluted with talc, gypsum or dolomite to contain 0.3 per cent. rotenone, were applied to larvae of *E. chrysorrhoea* and gave 98, 97 and 60 per cent. mortality, respectively, when the larvae were dry, and 94, 88 and 55 per cent. when they were wet. In 1943, when the same dusts were applied to larvae of *Diprion pini*, L., in the apparatus devised by Franssen [26 253], the dolomite mixture proved the most effective, giving 56-77 per cent. mortality as compared with 28-56 per cent. for talc and 47-69 per cent. for gypsum. This appeared to indicate that the previous low toxicity of the dolomite dust could not be attributed to the alkaline reaction of dolomite on derris during storage [cf. 34 89].

In tests with pyrethrum, dusts containing 0.025 per cent. pyrethrins in talc, gypsum, dolomite, fine bone dust, clay or light ash were applied to full-fed larvae of *D. pini*. When freshly prepared dusts were used, the best results, based on knock-down, were given by gypsum, talc and dolomite in that order, the others being far less effective, whereas the dolomite mixture proved the least effective of all after storage for three years. Chemical analysis showed that, after storage, the pyrethrin content of the dolomite dust was lower

than that of the talc dust, but this would not account for the lower toxicity of the former in the freshly prepared mixture. In similar tests on young larvae of *Bombyx mori*, L., with dusts three years old, the best results, based on mortality in 24 hours, were given by mixtures with gypsum and talc, the others all proving very inferior, but there was little difference in the effectiveness of freshly prepared mixtures with talc, gypsum and dolomite.

To test the influence of carriers on stomach poisons, dusts containing 60 or 40 per cent. sodium fluosilicate in gypsum, talc or dolomite were applied thickly to pine twigs, the surplus dust was blown off, and larvae of *D. pini* were placed on them. The results, based on mortality and the amount of food consumed as indicated by the weight of excreta, showed that the talc dusts were superior to those with gypsum or dolomite, which were about equal. When dust mixtures containing 10 per cent. sodium fluosilicate were applied to young larvae of *D. pini* in natural colonies, dolomite proved inferior to the other two carriers, but when young larvae of *B. mori* were placed on mulberry leaves dusted with the 60 per cent. mixtures, no significant differences were observed in their effectiveness.

Since these tests indicated that differences in the toxicity of the dust mixtures could not be attributed to chemical action of the carriers on the insecticides, the physical properties of the carriers were investigated. Talc, gypsum and dolomite, at rates equivalent to 30 lb. per acre, were tested in the dusting apparatus, in which they were allowed to fall on to glass slides; microscopic examination showed that the slides were not completely covered by any of the dusts, and it is concluded that, in the field, even the particles of a quick-falling carrier do not cover the dusted surface densely enough to screen it from the particles of insecticide. No basic difference was observed in the structure of the particles of dolomite and the other carriers. When they were mixed with finely ground derris (9:1) and tested in the same way, similar results were obtained, and when the derris was coloured red before being mixed, the derris particles were observed adhering to agglomerates of particles of the carrier, so that there had been no separation of the components in the process of settling. Tests on the speed at which the particles fell showed that each dust mixture comprised three fractions, in which the particles fell swiftly and vertically, more slowly and with a whirling movement, and very slowly in a fine, easily dispersed cloud. The first and second fractions of the dolomite mixture fell more slowly than those of the talc or gypsum mixture, talc had a small first fraction and a large third one and gypsum the exact reverse, while dolomite was midway between the two. The first fractions of all three dusts did not adhere so well as the others to the slides, but since chemical analysis showed that the first fraction of the dolomite dust did not contain a greater proportion of insecticide than those of the other mixtures, this lack of adherence could not account for the lower toxicity of derris in dolomite.

To compare the adherence of the carriers, weighed quantities of each were dusted on to wire gauze or a glass plate, the loose dust was gently knocked off and the adhering dust weighed. At a temperature of 62-67°F. and a relative humidity of 41-44 per cent., gypsum adhered less than talc or dolomite to both gauze and glass, while dolomite adhered the best to gauze and talc to glass. An electrical charge on the surface of the glass plate did not affect adhesion. At a relative humidity of 75-80 per cent., talc and dolomite adhered better to wire gauze than gypsum, while clay and light ash did not adhere so well as the latter.

The capacity of various carriers to absorb water was tested by exposing them in open petri dishes to a moist atmosphere. The six different samples of dolomite used absorbed 1-2 per cent. of their weight in moisture; talc absorbed no moisture, but gypsum, bone dust and clay absorbed considerable amounts. The quantity of moisture absorbed by the dusts had little influence on their adherence to zinc plates.

In tests with two proprietary dust preparations of calcium arsenate, the first adhered far better to glass than the second, but when they were applied to pine needles the reverse was the case. Of the three carriers tested, talc adhered best and gypsum least to pine needles when normally applied, but when the dusting was performed vigorously, gypsum adhered best, talc less well and dolomite least; this is thought to indicate that, in the field, different dusting techniques may require different dust mixtures.

Since no definite cause could be found for the variable results given by the different carriers, the authors conclude that none need be avoided if it appears economical, as does dolomite, but that an overdose of insecticide should be included to ensure adequate toxicity. Clay, bone dust and light ash are not recommended as carriers, as they are inferior and expensive.

LOMBARDINI (G.). *Tyroglyphus nadinus* n. sp.—*Redia* 30 pp. 43–69, 2 pls., 2 figs., 16 refs. Florence, 1944.

Descriptions are given of all stages of *Tyroglyphus nadinus*, sp. n., and its morphology and anatomy are discussed in relation to those of other Tyroglyphid mites. It was found in Florence in 1942 infesting two lots of condensed milk, which it turned rancid. This was evidently a favourable medium, since the mites continued to develop in it until all nutriment was exhausted, when they died out without producing hypopi. They were also found feeding on fruits, including pear, peach, apple and orange. They were able to develop under widely differing conditions of temperature and humidity and at all seasons of the year. When reared in the laboratory on pieces of pear, they developed most rapidly at 25°C. [77°F.], the egg, larval, and two nymphal stages lasting 7, 5, 3 and 2 days, respectively. The eggs hatched in 13 days at 6°C. [42.8°F.], but not at all at 32°C. [89.6°F.], whatever the humidity. Oviposition began about two days after pairing, the females laying some 20 eggs in about five days.

In experiments on alternative foods, *T. nadinus* did not multiply much in wheat flour, soon died in maize flour, and could not be reared at all on sugar, but thrived on cheese, lard and beef fat. When lizards, birds and mice were fed on substances infested with the mites there were no signs that these were able to survive in their digestive tracts, but they developed actively on putrefying organic matter. They survived for nearly two hours in alcohol (50, 75 or 95 per cent.), about an hour in oxalic acid and lactic acid, 15 minutes in acetic acid and 10 minutes in concentrated sulphuric acid, but died instantly when exposed to chloroform. They lived for two days in glycerine, for six days in a 3½ per cent. salt solution and for ten and 21 days, respectively, in 3 and 1 per cent. potassium hydroxide. Immature mites survived indefinitely in water but could not complete their development; the adults survived under water for many months with condensed milk as food and oviposited, but the resultant larvae did not moult.

Infestation by *T. nadinus* can be controlled by exposure for about 30 minutes to a temperature of 50°C. [122°F.]; store cupboards should be kept scrupulously clean, and fresh fruit, which may be infested, should not be put in them.

VENTURI (F.). *La Hylemyia genitalis* Schnabl (Diptera, Muscidae). Note biologiche e morfologiche. [*H. genitalis*: biological and morphological Notes.]—*Redia* 30 pp. 71–127, 2 pls., 18 figs., 3 pp. refs. Florence, 1944. (With a Summary in Latin.)

The author gives notes on the geographical distribution of the Anthomyiid, *Hylemyia genitalis*, Schnabl, which infests wheat throughout Italy and sometimes causes a certain amount of damage, together with a full description of all stages and an account of its bionomics based on his own work in Italy [cf. *R.A.E.*, A 25 213], and on that of other authors, particularly Kurdyumov

[**2** 350] in Russia [in which, however, a different species may have been concerned (cf. **27** 311)]. Cultural methods of control, including crop rotation, early or late sowing, the use of trap-crops, and the selection of resistant varieties of wheat, are discussed.

SERVADEI (A.). **Contributi alla conoscenza dell' entomofauna delle leguminose foraggere.** III. *Phytonomus nigrirostris* F. (Col. Curelioniidae). [Contributions to the Knowledge of the Insect Fauna of leguminous Fodder Plants. III. *Hypera nigrirostris*, F.]—*Redia* **30** pp. 129–179, 8 pls., 21 figs., 37 refs. Florence, 1944.

In this paper, which is the third of a series [cf. *R.A.E.*, A **36** 30], a detailed account is given of the bionomics, the morphology of all stages and the internal anatomy of the larva of *Hypera (Phytonomus) nigrirostris*, F., which is found on clovers (*Trifolium* spp.) and occasionally on lucerne in Italy. Observations made in Tuscany and Emilia in 1937–42 showed that oviposition took place between mid-March and mid-May, the females laying 20–30 eggs singly in the young leaves or shoots. The larvae hatched in about a week and migrated to the axils; they devoured the shoot and any new shoot that the plant produced to replace it, and also passed from one shoot to another. The flower buds were sometimes attacked. Older larvae fed on the stalks near the axil, often causing them to break off, and pupated in cocoons between the axillary bracts or leaves, avoiding direct sunlight. The larval and pupal stages lasted 14–20 and 13–16 days, respectively. The adults fed on the leaves, perforating them between the veins, and also on the stalks. They emerged from May onwards, aestivated during the heat of summer, and resumed activity in September. They hibernated either in the clover field or in shelters in the neighbourhood, paired when they emerged from hibernation, between mid-March and April of the following year, and survived until June or July.

The damage done to crops was not usually severe. The recommended method of control consists in cutting the infested clover early, before it flowers, in order to destroy the maximum number of larvae and eggs. It need not be used immediately, so long as it is removed from the field to avoid re-infestation.

KURIR (A.). **Einflüsse abiotischer Umweltfaktoren auf den Schwammspinner (*Lymantria dispar* L.) im Eistadium während der Winterdiapause.**

I. Wirkung des Eises. [The Influence of abiotic environmental Factors on Eggs of *L. dispar* during the Winter Diapause. I. The Effect of Ice.]—*Z. ges. Forstw.* **75/69** pt. 4–6 pp. 105–132, 10 figs., 30 refs. Berlin, 1943.

In northern Jugoslavia, where *Lymantria dispar*, L., is a serious pest in oak forests [cf. *R.A.E.*, A **24** 400–402], the control measure most commonly employed is to scrape the egg-masses from the trunks [cf. **15** 110] and leave them on the ground, where, it is assumed, they will be killed by frost and damp during the winter. Opinions in the literature differ regarding the effectiveness of this method, but most authors consider that egg-masses so exposed are unlikely to survive [cf. **22** 143; **34** 233]. In view of the lack of evidence, however, experiments were carried out near Zagreb in 1938–40 to determine to what extent the eggs are affected by winter conditions.

The structure of the egg of *L. dispar* is described. Embryonic development proceeds for 15–20 days after oviposition; the rate of metabolism falls very low in autumn and winter [cf. **23** 536], but increases in spring, when development is completed.

In the tests, many thousands of eggs collected from forests to the south of the river Drava were arranged in batches of 200 in glass vessels containing water, so that when they were placed in the open in December (1938) or January (1940) the eggs were either on ice or entirely surrounded by it; others, which served

as controls, were placed in sealed glass tubes on the ground. Some of the eggs in each series were stripped of their covering of hairs before exposure. The period of exposure for all groups was 60 or 70 days in 1938-39 and 52 days in 1940 (when the winter was exceptionally severe). In March, when the ice in the vessels had melted, the eggs were brought into the laboratory, dried and placed in petri dishes, and counts were made of the larvae of *L. dispar* that hatched and the adults of the Eupelmid, *Anastatus disparis*, Ruschka [see next abstract] that emerged. In all the tests, hatching began in late March. In the first year, when *Anastatus* emerged from an average of 7.2 per cent. of the eggs, the percentage mortality of the remaining eggs averaged 11.5 and 9.8 for those kept on and in ice, respectively, and 9.9 for those protected from it, and was somewhat lower among eggs from which the hairs had been removed than among the others. The percentage mortality among eggs deprived of their hairs that overwintered in the laboratory averaged 4.6. During the exposure period in the second year, the ground was covered with snow for much of the time and the average daily temperatures ranged from about -18°C. [-0.4°F.] to 11°C. [51.8°F.], with a minimum of -25.9°C. [-14.62°F.] on 15th February. The percentage of eggs from which *A. disparis* emerged averaged 0.6, and was highest from eggs stripped of their covering and exposed to ice. The percentage mortality of the remaining eggs with their natural covering averaged 1.8 for those kept on ice, 6.0 for those in ice and 1.6 for those protected from ice, while the corresponding percentages for eggs stripped of their covering were 12.4, 7.9 and 5.2; eggs that had been surrounded by ice appeared to have suffered no mechanical damage from pressure. There was no significant difference between these figures and those obtained the previous year for eggs that had overwintered in the laboratory, and the percentage of the latter that gave rise to *Anastatus* was smaller (0.2); it is therefore concluded that severe winter weather has no injurious effect on the development of the eggs or on that of the parasite. The covering of hairs apparently serves merely to hold the eggs together in the mass and not to protect them from low temperatures.

KURIR (A.). *Anastatus disparis* Ruschka, Eiparasit des *Lymantria dispar* L.
[*A. disparis*, an Egg Parasite of *L. dispar*.]—Z. angew. Ent. **30** pt. 4
pp. 551-586, 28 figs., 68 refs. Berlin, 1944.

In this detailed account of investigations carried out in northern Jugoslavia over several years on the bionomics of the Eupelmid, *Anastatus disparis*, Ruschka (*bifasciatus*, auct.) as an egg parasite of *Lymantria dispar*, L., its nomenclature and alternative hosts are reviewed from the literature and descriptions are given by J. Fahringer of the adults of both sexes. The material used in the work was obtained from oak forests south of the Drava. It was found that the percentage parasitism of the eggs varied from 0.2 to 68.5 and was highest in forests in which infestation by *L. dispar* was greatest. The sex ratio of the parasites varied considerably, the percentage of males being 53.6, 44.3, 74.2 and 25.8 in material from four forests of which the first was heavily and the last two lightly infested by *L. dispar*. Of the first 1,000 adults that emerged from eggs collected in a heavily infested area, 84-97 per cent. were males.

The emergence of the adults of *A. disparis* from eggs of *L. dispar* from different localities continued from 15th July to 17th August, or occurred within this period. It began two months after the last larva of *L. dispar* had hatched and reached a peak in about a week. The temperature range during the emergence period was 16-26°C. [60.8-78.8°F.]. From egg-masses of *L. dispar* collected in autumn and kept in the laboratory at room temperature until the following summer, parasite emergence began on 24th February, when all unparasitised eggs had hatched, reached a sharp peak in mid-June and continued

until 11th September. There is normally one generation a year in central Europe, and the author considers that a second is unlikely because only newly-laid eggs are parasitised. The aperture made in the egg-shell by the emerging parasite is round, whereas that made by the larva of *L. dispar* is elongated; eggs that have been parasitised can also be distinguished by the presence of the pupal skin of the parasite, excreta and other débris. Only one individual of *A. disparis* developed within one host egg.

Unfed adults, including some given pure water or water sweetened with saccharin, all died within four days. When fed on sugar-water, males and females that had paired lived for 8–16 and 12–29 days, respectively, and those that had not for 3–16 and 4–19 days. Pairing occurs soon after emergence and individuals of both sexes paired more than once. A fertilised female lays only 2–13 eggs, and this, combined with the poor ability of the females to fly, probably accounts for the slow increase of the parasite in some areas into which it has been artificially introduced [cf. *R.A.E.*, A 13 433]. The high percentage parasitism sometimes found in nature is probably the result of several females ovipositing in one egg-mass. Of 18 females that had paired once, only seven oviposited; their progeny totalled 20 females and 22 males. When fertilised and unfertilised eggs of *L. dispar* of various ages were offered, only fertilised eggs 1–3 days old were parasitised. In nature, eggs in the upper part of the mass were most frequently parasitised. Tests showing that the parasite can withstand low winter temperatures in the host egg are recapitulated [see preceding abstract].

Two hyperparasites, the Torymid, *Torymus anastativorus*, sp. n., and the Encyrtid, *Tyndarichus kuriri*, sp. n., the adults of which are described by Fahringer, were reared from *A. disparis* in the course of the investigations; neither was at all common.

KURIR (A.). Die Massenvermehrungsgebiete des Schwammspinner *Lymantria dispar* L. in Kroatien. [The Outbreak Areas of *L. dispar* in Croatia.]—16 pp., 4 pls., 3 figs., 1 fldg. map, 2 refs. Vienna, Südostinst. Wald- u. Holzforsch., 1944.

Lymantria dispar, L., is a serious pest in oak forests in northern Jugoslavia, particularly in the valleys of the Save and Drava, and districts in which outbreaks have occurred very frequently, often or seldom since 1866 are shown on a map. The oak forests in the Save valley, where the trees are more than 300 years old and over 80 ft. high, are constantly infested, and fruit-trees in this region are also sometimes attacked. The outbreak areas are chiefly those with an annual precipitation of 28–40 ins. and a mean annual temperature of 10.5–11.5°C. [50.9–52.7°F.]. The plant communities of the outbreak areas are discussed from the literature, and an account is given of the morphology and bionomics of the moth, together with brief notes on the known natural enemies of various stages and on measures for the destruction of the eggs and larvae.

DĄBROWSKI (Z.), KAMIŃSKI (E.) & RUSZKOWSKI (J.) Ed. Ochrona roślin. [Manual of Plant Protection.]—*Bibl. Puławskie* no. 22, 9½×6½ ins., 491 pp., 1 fldg. col. pl., 296 figs., 2½ pp. refs. Puławy [Państw. Inst. nauk. Gosp. wiejsk. w Puławach] 1946.

This text-book for agricultural students, to which 12 authors have contributed, deals with diseases and pests, chiefly insects, of cultivated plants and stored fruits, vegetables and grain that occur in Poland or are likely to become established there. It begins with a discussion of the economic importance of diseases and pests in agriculture, and an account of the organisation of the Plant Protection Service in Poland before and after the war, followed by information on plant diseases caused by environmental factors and those caused by viruses,

fungi and bacteria, which are dealt with very briefly, and notes on the classification of plant pests, the morphology and anatomy of insects, and the types of injury caused by various pests. The main part (about 280 pages), which is arranged under the crops and products infested, comprises notes on the individual pests, including morphology, life-history, damage caused and appropriate control measures. In further sections, agricultural, mechanical, chemical and biological control measures in general are discussed, machines for applying sprays and dusts are described, and a list is given of Polish and foreign proprietary materials. Notes on plant quarantines and their organisation in Poland are included, and a bibliography of the more important literature and a subject index are appended.

Prangos pabularia Lindley and the Problems of its Use as a Drug Plant. [In Russian.]—Trans. Molotov Univ. Rostov-on-Don 1 Wks biol. Fac. no. 5, 88 pp., 10 figs., refs. Rostov-on-Don, 1946. (With a Summary in English.)

Of the six papers in this symposium on *Prangos pabularia*, a wild perennial umbelliferous plant common in mountainous districts in the southern part of Central Asia, one deals with its classification, morphology, ecology and geographical distribution, another with the soils in which it grows, and two are noticed elsewhere [R.A.E., B 36 58].

In Chemical Investigation of the Roots of *Prangos pabularia* (pp. 52-60) D. E. DIONIS'EV shows that the roots contain 1.67-9.04 per cent. tannins (dry weight) and the root bark 13.57-19.79 per cent. resins, depending on the season of the year. The content of alkaloids is insignificant. The content of resins was slightly lower at the end than at the beginning of summer, but the content of tannins doubled; both were at their lowest in winter. The composition of the roots remained practically unaltered during storage in summer or winter. When prepared from the same quantity of roots and equally diluted, a decoction had a higher surface tension and viscosity than an infusion.

In Contribution to the Study of the acaricidal and insecticidal Properties of Preparations of *Prangos pabularia* (pp. 72-82), B. V. DOBROVOL'SKII gives an account of experiments carried out in 1943 in western Kirghizia to test the value as sprays of a decoction and an infusion of the roots. Thick roots of non-flowering plants dug in mid-June 1943 and containing 18.4 per cent. resins and 4.16 per cent. tannins were pounded and either boiled for three hours in twice their weight of water, giving a decoction containing 6.5 per cent. resins, or steeped for three days in twice their volume of water.

Spraying with the undiluted decoction or infusion or with the decoction at half strength gave almost complete mortality of *Tetranychus* (*Eotetranychus*) *turkestanii*, Ugar. & Nik., on cotton and complete mortality of *Tetranychus* sp. on pears; the infusion at half strength killed all the mites on pear, but only 90 per cent. of those on cotton. At lower concentrations, both gave progressively lower mortality. Both preparations were effective against *Chromaphis* (*Callipterus*) *juglandis*, Goeze, on walnut in the laboratory, but ran off the leaves in the field and killed only very small nymphs. When young cabbages heavily infested with *Brevicoryne brassicae*, L., were sprayed, both preparations (undiluted) were effective only against the Aphids in depressions on the leaves. No control was obtained of *Eriosoma lanigerum*, Hsm., on apple, or *Psylla pyricola*, Först., on pear.

It is concluded that though the tannins of *Prangos* probably act as a contact poison, the action of the sprays is due chiefly to the resinous material, which envelops mites and Aphids and fixes them to the leaves and is more effective against mites, because they are smaller. Since the sprays do not wet leaf surfaces well and tend to run off, they adhere best where exposure to

the sun results in rapid evaporation. Only concentrated sprays would leave an adequate deposit of resins and they would require more material than could be economically obtained.

MUZAFFER AHMAD. **Some new Species of parasitic Hymenoptera from India.**—*Indian J. Ent.* 7 pt. 1-2 pp. 5-11, 3 figs. New Delhi, 1946.

The new species described comprise three Torymids without specific host records, *Apanteles crocidolomiae*, reared from *Crocidolomia binotalis*, Zell., in northern Bihar, and *A. euproctisiphagus*, from *Euproctis lunata*, Wlk., in New Delhi.

NEWMAN (J. F.). **A Study of the digestive Enzymes of the larval Gut of *Dinoderus ocellaris* (St.).**—*Indian J. Ent.* 7 pt. 1-2 pp. 13-19, 5 refs. New Delhi, 1946.

An account is given of the technique and results of tests of the action, on various constituents of wood, of the enzymes contained in aqueous extracts of the guts of larvae of two Coleoptera that infest bamboos in India. The results showed that the enzymes of *Dinoderus ocellaris*, Steph., can attack and digest sucrose, starch and protein, but not cellulose (from filter paper) or hemicellulose (from bamboo), whereas those of *Chlorophorus annularis*, F., acted on the cellulose, but, unexpectedly, not on the hemicellulose.

TASKHIR AHMAD & ISHWAR DAYAL MATHUR. **The Biology and Ecology of *Melcha ornatipennis* Cameron, a Parasite of the Top Shoot Borer of Sugarcane, *Scirpophaga rivella* Fabr.**—*Indian J. Ent.* 7 pt. 1-2 pp. 21-36, 12 figs., 6 refs. New Delhi, 1946.

This paper contains the results of laboratory and field observations in New Delhi, some of which have already been noticed [R.A.E., A 32 412], on the bionomics of *Melcha ornatipennis*, Cam., an important local parasite of the top shoot borer of sugar-cane, *Scirpophaga rivella*, F., in northern India and Burma. In laboratory experiments at constant temperatures of 11, 15, 20, 25, 30 and 35°C. [51.8, 59, 68, 77, 86 and 95°F.], the egg stage averaged 13.5, 6.27, 2.71, 2.13, 1.2 and 1.17 days, respectively; 50 per cent. of the eggs hatched at the lowest temperature, and all at the others. The larvae were unable to develop at 11°C., and became fully grown in averages of 27.77, 9.13, 6.5, 4.36 and 4.54 days at 15, 20, 25, 30 and 35°C., respectively. Mortality was less than 8 per cent. at 15 and 30°C., and higher mortality at 20 and 25°C. was due to a fungus that is not likely to be of importance in the field. All pupae died at 15°C. and 50 per cent. did so at 35°, but all survived at the intermediate temperatures. The pupal stage lasted about 16, 10 and 7 days at 20, 25 and 30°C., and was a little shorter at low relative humidities. The optimum temperature was 30°C. for the inactive stages and 20°C. for the adults. Fertilised females survived for not more than 14 days in the summer and about 20 in winter. Hibernating larvae resumed and completed their development when transferred to a temperature of 30°C.

In the field, the sex ratio changes in a way that favours the survival of the species. The activity of the overwintered generation begins in July, soon after the rains, when it is important for the relatively scarce overwintered host larvae to be found and parasitised before they pupate. Females are predominant in this generation, but the proportion of males subsequently increases, owing to parthenogenetic reproduction during the summer, and they are about as numerous as the females by the autumn. This enables most of the autumn females to be fertilised, so that few males are produced in the overwintering

generation. The rate of natural parasitism of *S. nivella* by *M. ornatipennis* is sometimes over 40 per cent., and the authors suggest that the effectiveness of the parasite could be increased by the release of laboratory-reared stocks. So far as is known, *S. nivella* is its only host and it is not itself attacked by any parasite.

NEGI (P. S.), GUPTA (S. N.), MISRA (M. P.), VENKATARAMAN (T. V.) & DE (R. K.).

Biological Control of *Eublemma amabilis* Moore by one of its indigenous Parasites, *Microbracon greeni* Ashmead.—*Indian J. Ent.* 7 pt. 1-2 pp. 37-40, 2 refs. New Delhi, 1946.

Investigations on the biological control of *Eublemma amabilis*, Moore, an important predator on the lac insect [*Laccifer lacca*, Kerr], have been in progress in Bihar since 1941 [cf. *R.A.E.*, A 34 164, etc.]. *Camponotus compressus*, F., and *Solenopsis geminata rufa*, Jerd., prey on the larvae and pupae, but are of little value in the field since they do not attack the concealed ones. The indigenous parasites of the Noctuid comprise *Trichogrammatoidea nana*, Zehnt., which attacks the eggs, *Elasmus claripennis*, Cam., *Bracon* (*Microbracon*) *greeni*, Ashm., *Pristomerus testaceicollis*, Cam., and *Aphrastobracon flavipennis*, Ashm., which attack the larvae, and *Brachymeria tachardiae*, Cam., which attacks the pupae. The value of releasing *Bracon greeni* was tested in two areas, in one of which the lac insects were on *Schleichera trijuga* and in the other on *Butea frondosa*. The parasites, obtained by collecting or from laboratory stocks, were liberated once or twice a week, starting when larvae of *Eublemma* began to reach a stage suitable for attack, and the experiments were continued during seven successive crop seasons on *S. trijuga* and five on *B. frondosa*; the numbers of parasites released varied considerably, ranging from 64 to over 20,000. The numbers of larvae and pupae of *Eublemma*, of parasitised larvae and of larvae in a stage suitable for parasitisation on samples of lac-bearing shoots from the experimental and control areas were counted each week, and the figures for each season are given in a table. As compared with the corresponding control area, the percentage parasitism in the experimental area was lower in the first two seasons, equal in the third and progressively higher in the next four on *Schleichera*, and more or less equal in the first two seasons and progressively higher in the next three on *Butea*.

HAROON KHAN (M.) & VERMA (P. M.). **Studies on *Earias* Species (the Spotted Bollworms of Cotton) in the Punjab. Part III. The Biology of the common Parasites of *E. fabia* Stoll, *E. insulana* Boisd. and *E. cupreoviridis* Walker.**—*Indian J. Ent.* 7 pt. 1-2 pp. 41-63, 15 refs. New Delhi, 1946.

The results are given of studies in 1934-37 on the bionomics of five parasites of *Earias fabia*, Stoll, *E. insulana*, Boisd., and *E. cupreoviridis*, Wlk., on cotton in the Punjab. Each of them attacks all three species of *Earias*, and the two ectoparasites of the larvae, *Elasmus johnstoni*, Ferrière, and *Bracon lefroyi*, D. & G., also attack *Platyedra gossypiella*, Saund. The female of *Elasmus johnstoni* deposits one or more eggs on or near a host larva enclosed in a flower bud of cotton; only one or two eggs or larvae were found on individual larvae of *P. gossypiella* either in the field or in the laboratory, but there were usually more than one on larvae of *Earias*, with a maximum of five in the laboratory and 21 in the field. Individual females laid about 18 eggs during September-October or about 13 in November, when the mean temperature fell below 75°F.; the maximum number of eggs laid by one female was 31. Unmated females produced male offspring. Males and females provided with sugar solution and allowed to reproduce survived in the laboratory for 5-16 and 7-46 days, respectively. Development required ten days during the hotter months and

28 days or more in the cooler ones, and an experiment showed that it could be completed on larvae that had spun their cocoons.

Bracon lefroyi normally attacks larvae within the flower buds or bolls; the number of eggs on individual hosts varied considerably, but was usually 1-4. In June-September, females laid most of their eggs within six days of emergence and all in 15-18 days, but oviposition became irregular and more protracted as the temperature fell, though it still occurred in December at a mean temperature of about 60°F. The maximum number of eggs laid by one female was 143; the average per female was highest (over 45) at mean temperatures of 81-87°F. The survival period of the adults varied from two to 83 days and was shortest at high temperatures. Development was completed in eight days during August-September and 18 in November. Females bred from *Earias* spp. oviposited more freely on *Earias* than on *Platyedra*, but those bred from *Platyedra* showed no marked preference. The largest numbers of immature parasites found on single larvae of *Earias* and *Platyedra* in the field were 24 and eight, respectively. Females were less numerous than males among parasites reared in the laboratory, but the proportion was increased when the parent females were allowed to mate with several males and when they were exposed to direct sunlight for an hour each day.

The observations on *Rogas testaceus*, Spin., an endoparasite of the larvae of *Earias*, in general confirmed those of Ahmad [R.A.E., A 33 389]. The adults mated soon after emergence and the females began to sting host larvae on the same day. Individual females laid only one egg in each host, but several sometimes oviposited in the same larva. The paralysed larvae became active and fed normally after 8-12 minutes, but stopped feeding again after a period of days depending on the temperature and died shortly afterwards. The largest number of larvae parasitised by one female was 18; the survival period of females provided with food and allowed to mate and oviposit varied from 5 to 73 days and was shortest at high temperatures. In general, males were more numerous than females.

Brachymeria tachardiae, Cam., is an endoparasite of the pupae of *Earias*. The females stung individual pupae repeatedly, but deposited only one egg in each; the largest number parasitised by one female was 40. Oviposition ceased at a mean temperature of about 60°F. The duration of the life-cycle ranged from about 11 days in June to 96 days in the field in winter, when the immature stages survived minimum temperatures of 32°F. or less. The parasite was unable to develop at a temperature of 98.5°F. The sex ratio was about equal in the field, but males were more numerous among parasites reared in the laboratory. The females, which lived longer than the males, survived for 6-19 days during July-September and for up to 132 days during November-March.

Goryphus nursei, Cam., is an ectoparasite of the pupae of *Earias* and deposits its eggs on the pupae within their cocoons. Females laid 15-51 eggs, depositing 1-7 on individual pupae. The eggs were not evenly distributed among the available hosts, some receiving none when others received several. Oviposition continued throughout the life of the female; most eggs were deposited 4-6 days after emergence in April and during the first three days in August-October. When paired parasites were provided daily with fresh host pupae, the largest number of progeny obtained from one pair was 14; neither moth nor parasite emerged from most of the pupae, and it is thought that several eggs were laid on each and that the food supply was insufficient for the resulting larvae. The survival period of females varied from five days in June to 102 in winter; that of males was rather shorter. The duration of the life-cycle ranged from ten days in summer to 86 in winter. The sex ratio appeared to be approximately equal.

It is probable that all five parasites overwinter in both adult and immature stages.

AFZAL HUSAIN (M.) & MATHUR (C. B.). **Studies on *Schistocerca gregaria* Forsk.**
XIII. Sexual Life.—*Indian J. Ent.* 7 pt 1-2 pp. 89-101, 10 refs. New Delhi, 1946.

The process of mating in *Schistocerca gregaria*, Forsk., and the behaviour of the locusts during it are described from observations made in the Punjab. The locusts are less easily disturbed when mating than at other times, and it is suggested that swarms that have settled for this purpose could be destroyed by beating with bushes or wire gauze beaters. Experiments in which natural phenomena were simulated showed that mating is not interrupted by rain, noise or moderate wind, and is interrupted by flooding only when the water is deep enough to reach the male. It is concluded that swarms are disturbed by the movements of men beating drums and tins and not by the noise made by them. Both the duration and frequency of mating varied. The preoviposition period of females mated with young males was shorter than that of females of the same age mated with older males. Four of 35 unmated females each deposited an egg pod after a preoviposition period of a month, and the two that hatched each gave rise to males and females in approximately equal numbers; these were reared to the adult stage, but attempts to produce a second parthenogenetic generation were unsuccessful.

Short Notes and Exhibits.—*Indian J. Ent.* 7 pt. 1-2 pp. 237-242. New Delhi, 1946.

A. C. Sen (p. 237) gives the results of observations on the bionomics of *Dinoderus ocellaris*, Steph., in stored bamboo at Cawnpore. The gallery made by the adult follows a zig-zag course and is filled with frass, which is hard and dry near the entrance. Eggs are deposited singly in the moist frass towards the end of the tunnel. The egg, larval and pupal stages occupied 2-4, 26-45 and 4-5 days, respectively, at 84°F. Mortality among the larvae and pupae was high, probably owing to the frequent disturbance.

K. B. Lal (pp. 237-238) states that extensive oviposition by *Schistocerca gregaria*, Forsk., occurred in the third week of July 1942 in open land near Orai in the United Provinces. Examination on 2nd August, when the eggs were being dug up as a control measure and a few had hatched, showed that 15-20 per cent. of the egg-pods were being attacked by earwigs; these destroyed only some of the eggs in the pods and were not numerous enough to cause any appreciable reduction in the numbers of the locusts.

R. M. Verma (p. 238) describes changes in appearance undergone by pupating larvae of the mustard sawfly, *Athalia proxima*, Klug, kept without material in which to shelter. In the field, the larvae enter the soil when fully fed and construct parchment-like cocoons covered with a thin layer of soil, in which the prepupal and pupal stages are passed.

P. L. Chaturvedi (pp. 238-239) gives the results of observations on the oviposition habits of *Hieroglyphus nigrorepletus*, Bol., a serious, but sporadic pest of sugar-cane, maize and sorghum in the eastern United Provinces, made during an outbreak in the autumn of 1944. Mating was observed, though not commonly, in September, and oviposition continued from mid-September to mid-November, after which no adults were seen. The egg-pods generally occurred within about 5 ins. of the sugar-cane clumps at a depth of 2-5 ins. in soil that, at this depth, was rather hard; the maximum number at one clump was 20.

K. M. Gupta (pp. 239-240) reports that *Phyllotreta cruciferae*, Goeze, which had not previously been recorded as a pest in India, caused serious damage to cabbage and other crucifers at various places in the United Provinces in 1941 and subsequent years. Observations at Cawnpore between September 1943 and May 1945 showed that the adults are most numerous from mid-March to

mid-June ; this is the growing period of summer radish, which is often destroyed soon after germination. The highest adult population observed was 900 per 100 plants in April 1945 and the lowest 0.4 per 100 plants in August 1944 ; 8.5 per square yard emerged in a radish field in the second half of April 1943. In experiments on control, only small percentages of the beetles could be caught in hand-nets or on a piece of cardboard painted with an adhesive and moved about over infested plants. Spraying with a mixture of 4 oz. lead arsenate paste, 3 oz. lime and 6 oz. molasses in 4 gals. water reduced injury to radish plants by 54.3 per cent.

T. Ahmad (pp. 240-241) reports that the Lygaeid, *Spilostethus pandurus*, Scop., was found attacking peaches in the Jelam district of the Punjab in July 1945, when as many as 15-20 bugs were observed on a single fruit. Their feeding caused the fruits to ferment and fall in a day or two, and they then left them and attacked fresh fruits that were nearly ripe on the trees. Somewhat similar damage to mango fruits by this Lygaeid was reported at Agra.

M. Atiqur Rahman Ansari (p. 241) records serious damage to summer and winter crops of guava in the Punjab by *Dichocrocis punctiferalis*, Gn., which was previously known as a pest of castor [*Ricinus communis*]. The larval and pupal stages are passed in the fruits, which dry up and fall without ripening. The collection and destruction of infested fruits was an effective measure. Ansari (pp. 241-242) also gives lists of wild and cultivated food-plants of *Pseudococcus filamentosus*, Ckll., and *Coccus discrepans*, Green, in the Punjab. *P. filamentosus* is recorded from 15 plants including *Citrus*, fig, mango, mulberry, guava and grape-vine, and *C. discrepans* from ten, including fig, grape-vine, *Eugenia cumini* (*jambolana*) and *Dalbergia sissoo*, a three-year-old plant of which was killed by it in one year.

Gurcharn Singh Sohi (p. 242) states that dusts containing 0.5-4 per cent. DDT in cow-dung ash were tested against various insect pests on potted vegetable plants. *Urentius sentis*, Dist., *Empoasca devastans*, Dist., Aphids, and larvae of a sweet-potato leaf-roller were killed within 24 hours, and adults of *Aulacophora foveicollis*, Lucas, adults and larvae of *Epilachna vigintioctopunctata*, F., and *E. dumerili*, Muls., *Bagrada cruciferarum*, Kirk. (*picta*, F.), and larvae of *Pieris brassicae*, L., died in 24-48 hours. Similar results were obtained in field trials with *Empoasca devastans* and *U. sentis*.

WALOFF (Z.). Seasonal Breeding and Migrations of the Desert Locust (*Schistocerca gregaria* Forskål) in eastern Africa.—*Anti-Locust Mem.* no. 1, 74 pp., 2 figs., 30 maps, 2 pp. refs. London, 1946.

The breeding and migrations of *Schistocerca gregaria*, Forsk., in eastern Africa were studied from some thousands of records of locust activity received by the Anti-Locust Research Centre during the outbreak of 1928-31 and the outbreak that began in 1941, which were plotted on maps and correlated with local rainfall and seasonal winds and temperatures. The methods adopted in mapping the records are described, together with the topography and climate of the area, which is included in Abyssinia south of latitude 12°N., French and British Somaliland, Somalia, the south-east of the Anglo-Egyptian Sudan, Kenya, and parts of Uganda and Tanganyika.

Breeding takes place from October-November until January-February in the lowlands and low plateaux of a belt extending from French and British Somaliland through Somalia, south-eastern Abyssinia and northern and eastern Kenya into northern Tanganyika and sometimes to north-western Kenya and Uganda, and coincides with the short rains (October-December) over much of the area ; it begins in October in the Somali Peninsula, in November in southern Somalia and Kenya, and in November-December in Tanganyika. It takes place again from March-April until June-July in a belt that covers

approximately the same area, but extends farther to the west and does not include parts of the coastal plains ; over much of it, breeding coincides with the long rains (March–May), but there is no clear-cut latitudinal sequence, as there is during the short rains. In isolated areas in eastern Abyssinia, British Somaliland and Somalia and in parts of Kenya, Uganda and the Sudan in the neighbourhood of Lake Rudolph, the locusts also breed during July–October ; this is termed monsoon breeding because it corresponds with the monsoon breeding season that occurs farther north and, in Abyssinia, is connected with rains that are possibly associated with the south-west monsoon. Over most of the area under consideration, breeding thus occurs twice a year, generally during the short and the long rains, but in parts of Abyssinia, Kenya and the Sudan, during the long rains and the monsoon season. It takes place only once a year in certain extremely arid regions and in regions where there is only one rainy season a year, but in two widely-separated parts of the monsoon breeding areas, it may occur in all three seasons.

Sexually immature adults of the generation that develops during the short rains form migrating swarms between December and early March ; they appear first in the eastern half of the area and their predominating movement is to the south-west except in the north of the Somali Peninsula and central and north-eastern Abyssinia, where it is to the north. As a result, swarms congregate on the plateaux. The locusts begin to oviposit in March, and the mature and ovipositing swarms migrate to the north along the plateaux and the Rift Valley from Tanganyika to north-eastern Abyssinia, and, at the same time, to the east from north-eastern Abyssinia to the Somali Peninsula, and to the south-west over the Somali Peninsula, from which the eastern lowlands are invaded again. The swarms die off in June, when they occupy an area largely coinciding with the long-rains breeding belt. Swarms of the long-rains generation appear in May–July, swarm formation continuing on higher ground into August, and migrate north-westward to the plateaux. The general trend of migration among the mature swarms, which occurs from September–October until January, is similar to that of the mature swarms of the short-rains generation. The monsoon generation develops from eggs laid in July–September by females of the long-rains generation and forms swarms from August to early November ; these migrate in the same direction as locusts of the long-rains generation that have not yet oviposited. The area covered by this migration includes the short-rains breeding belt, but extends far to the west of it. Swarms that oviposit in the short-rains breeding area die in December–February, but some of those to the west, where breeding is prevented by drought, probably survive to take part in the early stages of the next long-rains breeding season.

Migrating swarms sometimes pass between British East Africa and the Belgian Congo in either direction, but the immigrant swarms do not breed. Some locusts of the short-rains generation enter and breed in northern Abyssinia and Eritrea during January–June and even reach Arabia, locusts of the long-rains generation may enter and breed in northern Abyssinia and Eritrea during June–August, and some of the monsoon generation may enter Eritrea, and possibly the Sudan, and fly from there to Arabia in October–December. The Abyssinian plateau is sometimes invaded by swarms passing through the Sudan, and others from Arabia may invade and breed in the northern part of the Somali Peninsula during March–November.

The following is largely the author's summary. The characteristic feature in the behaviour of swarms is their mobility, which is more or less continuous throughout the adult life, is not confined to any part of it, and persists even during the oviposition period. There is no evidence of any inherent urge to migrate in any particular direction. Apart from some important exceptions when swarms migrate across or against the wind, the major trends of migrations are down the prevailing winds, and change with them. The old mature swarms,

however, tend to fly against the wind. In the absence of rain, non-laying swarms are very active at average monthly maximum temperatures of 28°C. [82.4°F.] and over, but their activity is reduced when the average monthly maxima do not exceed 20–22°C. [68–71.6°F.]. The activity of ovipositing swarms is also reduced by high temperatures. Owing to the effect of temperatures on flying activity, the highlands tend to trap the swarms during the cool season, until the general rise of temperatures enables them to spread; persistent high temperature in dry weather leads to the evacuation by the swarms of an area where such conditions obtain. The distribution of swarms at any season is thus largely dependent on the pattern of air temperatures and winds. In this species, which has no fixed annual breeding cycle, the incidence of breeding depends, among other factors, on the incidence of suitable rainfall. Because of this and of the mobility of the swarms, the situation of breeding areas is not constant, but follows seasonal changes in rainfall distribution. The number of breeding seasons per year in any area is largely determined by the local rainfall. There is no evidence that migrations involve a search for suitable breeding conditions. The seasonal trends of migrations and the changing situation of breeding areas combine to produce a fairly regular pattern of seasonal distributions over East Africa. This regularity depends on the physiological responses of the locust to climatic factors, the pattern of which changes from season to season in a regular manner, and is not due to migration or breeding cycles inherent in the species.

MOUTIA (L. A.). Notes sur l'introduction à Maurice de l'insecte : *Anaphoidea nitens* Gir., le parasite du charançon de l'Eucalyptus : *Gonipterus scutellatus* Gyll.—*Rev. Agric. Maurice* 25 no. 5 pp. 211–212, 1 ref. Port Louis, 1946.

All the insects in two batches of *Anaphoidea nitens*, Gir., brought to Mauritius by air from South Africa in March and April 1946 for the control of *Gonipterus scutellatus*, Gylh., on *Eucalyptus* [cf. R.A.E., A 34 102], died before or shortly after arrival, but examples of this Mymarid were obtained from 780 egg-capsules of the weevil received from Nairobi [cf. 36 106] in April. Between then and July, eight generations were reared in the laboratory, and 5,632 individuals were liberated in 18 localities infested by *Gonipterus*. Examination of egg-capsules collected in late July in a locality in which the liberation had been made three months previously showed that many of them were parasitised, and the Mymarid is thought to have become established. It is stated in a footnote that parasitised egg-capsules had been found in the field at three other liberation centres by late September, the percentage parasitised ranging up to 77.3 and the numbers of parasites obtained per capsule averaging 5.

SILVA (P.) & HEINRICH (C.). *Stenoma decora* Zeller (Lep. Stenomatidae), uma nova praga potencial do cacaueiro na Baía, Brazil. [*S. decora*, a new potential Pest of Cacao in Bahia.]—*Rev. Ent.* 17 fasc. 3 pp. 361–374, 16 figs., 27 refs. Rio de Janeiro, 1947. (With a Summary in English.)

Notes are given on the systematic position and the geographical distribution in Brazil of the Tineid, *Stenoma decora*, Zell., which causes some injury to cacao in Bahia [cf. R.A.E., A 32 289; 34 5] in plantations in which kapok (*Ceiba pentandra*), its more usual food-plant, is used as a shade tree. The male is redescribed and the female, larvae and pupa are described for the first time. The larvae feed in the bark of the trees, sometimes causing the death of young cacao plants and reducing the yield. They also mine in the young twigs of kapok, and in the epicarp of cacao fruits, facilitating the entry of fungi. The

adults, which are active at night, were taken in the field from January to April. The Eupelmid, *Arachnophaga hirtibasis*, Gahan, was reared from *Stenoma* pupae found on kapok in 1943.

CALLAN (E. McC.). **A Note on *Sarcophaga lambens* (Wied.), a Parasite of the South American Bollworm, *Sacadodes pyralis* Dyar.**—*Rev. Ent.* 17 fasc. 3 pp. 474-475, 5 refs. Rio de Janeiro, 1947.

Of nearly 35,000 bolls of Sea Island cotton picked in March 1941 in Trinidad, 2 per cent. were infested by *Platyedra gossypiella*, Saund., and 22 per cent. by *Sacadodes pyralis*, Dyar; the parasite, *Sarcophaga lambens*, Wied. (*sternodontis*, Tns.) emerged in the laboratory from 12.4 per cent. of the larvae of the latter. This Sarcophagid occurs from the southern United States to Argentina [cf. *R.A.E.*, A 16 82], and notes are given on its known hosts; it has not previously been recorded from *Sacadodes pyralis*, which is an important pest of cotton in Argentina, Colombia [26 403] and Venezuela and also occurs in Trinidad and British Guiana [cf. 15 238]. Brief notes are given on the habits of the Sarcophagid. Up to 10 larvae were found within a single host, which they left to pupate in the sand in the breeding jars. The adults emerged 7-14 days later and survived for 7-10 days when fed on sugar and diluted honey.

[Report of the Biology Department.]—56th Rep. N. Mex. agric. Exp. Sta. 1944-45 pp. 44-48. State College, N. Mex., 1945.

DDT gave promising results against the codling moth [*Cydia pomonella*, L.] on apple in New Mexico in 1944, though it was slightly less effective than the standard schedule. Trees of the Arkansas Black variety that received a calyx spray of 3 lb. lead arsenate and 4 oz. colloidal spreader per 100 U.S. gals. water, followed by six cover sprays of 3 lb. standard lead arsenate and $\frac{1}{2}$ U.S. gal. summer oil, three of the lead arsenate and oil and three of $1\frac{1}{2}$ lb. nicotine bentonite and $\frac{1}{2}$ U.S. gal. summer oil, or six of 2 lb. 20 per cent. DDT per 100 U.S. gals. water had 97.4, 93.6 and 92.1 per cent. uninjured fruit, and trees of Stayman Winesap, on which only the last two schedules were tested, had 82.5 and 80.9 per cent.

In tests in 1945 on the control of *Heliothis armigera*, Hb., on sweet maize by the treatment of the ears, the silks were thoroughly coated with the insecticides, which were applied once at the beginning of the silking period. The numbers of larvae per ear and (in brackets) percentages of the ear area injured averaged 1.75 (7.5) for a spray of 1 lb. DDT in a water-dispersible powder with $\frac{1}{2}$ U.S. gal. summer oil per 100 U.S. gals. water, applied with a small hand sprayer, 1.13 (9) for a dust of 3 per cent. DDT in pyrophyllite and 1.88 (8.13) for a mixture of dusting sulphur, cryolite and an inert material (6 : 2 : 2), both applied with a hand duster, 0.56 (2.8) for white mineral oil containing 1 oz. pyrethrum extract per U.S. gal., applied with an oil can, and 1.88 (9.38) for no treatment, and it is concluded that no other treatment was so effective as the pyrethrum in oil.

Experiments on the control of *Frankliniella occidentalis*, Perg., were carried out during the early growing period of the onion seed crop, which suffers severe infestation in March and April. A spray of 1 lb. actual DDT in a water-dispersible powder per 100 U.S. gals. water, a dust of 3 per cent. DDT in pyrophyllite, and Lethane B-71 dust (14 per cent. β - β' -dithiocyanodiethylether) were applied on 21st and 30th March, and population counts were made before and 72 hours after each treatment. The figures for percentage control, estimated by Abbott's formula [*R.A.E.*, A 13 331], and (in brackets) the percentage reduction in thrips population as compared with that on untreated plants after the first and second applications were 40.3 (29.3) and 88.2 (74.2) for the DDT spray, 42.6 (42) and 82.1 (89.8) for the DDT dust, and 17.6 (21.4) and 8.2 (26.3) for the Lethane dust, and the average yields of cleaned onion seed at

harvest were estimated as 519.2, 431.3 and 393.2 lb. per acre for the three treatments and 308.6 lb. per acre for no treatment, the differences in yield between plots treated with DDT and with Lethane approaching significance.

CHANDLER (S. C.). Experimental Work with DDT on Fruit Insects in 1945.—
Trans. Ill. hort. Soc. 1945 **79** pp. 274–290. Quincy, Ill., 1946.

The author describes experiments carried out in 11 apple orchards in nine counties of Illinois in 1945 to compare sprays containing DDT in suspension with the regular spray schedules of lead arsenate, fixed nicotine or both for the control of the codling moth [*Cydia pomonella*, L.]. From the results it is concluded that DDT gave better control than lead arsenate or nicotine, even where fewer sprays were used, the infestation being 1½–19 times as great in plots treated with the standard sprays. There was considerable evidence that DDT with summer oil can be used less frequently or at longer intervals than the standard sprays and still give better results, though the best results were obtained when the intervals between sprays were the same as in the standard schedules. A combination of $\frac{1}{4}$ – $\frac{1}{2}$ lb. actual DDT with 2 lb. lead arsenate in 100 U.S. gals. water was found to be practically as effective as 1 lb. DDT alone, but a factory-mixed combination of 7 per cent. DDT and 14 per cent. fixed nicotine used at 2 lb. per 100 U.S. gals. with oil was rather less effective. Control of apple leafhoppers was invariably better with DDT than with the standard sprays, although no special efforts were made to apply it at the period of highest nymphal populations, as is necessary when nicotine sulphate is used. All trees but those of the Winesap, Stayman, York and Maiden Blush varieties showed foliage injury when sprayed with DDT and summer oil; the injury was more severe on trees receiving the larger dosages of DDT, and it is thought that it might be reduced by decreasing the dosage of oil to 1 quart per 100 gals. or by using a slurry of soy-bean flour and lime [cf. *R.A.E.*, A **35** 319]. Injury by the European red mite [*Paratetranychus pilosus*, C. & F.] or the common red spider [*Tetranychus*] was moderate to severe in all DDT plots and greater in those receiving the larger dosages [cf. **35** 320]. *Tetranychus* was the more numerous in all the tests. The fruit on trees treated with DDT was greener than that on trees receiving the standard schedules in three orchards, smaller in two and more russeted in three. In spite of the effectiveness of DDT in these experiments, it is not recommended for general use without further research.

In experiments in four vineyards, sprays of 1 lb. DDT per 100 U.S. gals. Bordeaux mixture gave outstanding control of the grape leafhopper [*Erythroneura*]; they were clearly superior to sprays of lead arsenate against the grape berry moth [*Polychrosis viteana*, Clem.] in two of them and of value in the other two, in which their true effectiveness might have been obscured by inequality of infestation. No investigations were carried out on peach, as DDT has been found ineffective against the plum curculio [*Conotrachelus nenuphar*, Hbst.] and parasites have given adequate control of the oriental fruit moth [*Cydia molesta*, Busck] in Illinois and might be affected by it.

BLANCH (G. E.). Apple Quality and its Effect on Price and Rate of Sale.—
Bull. Cornell agric. Exp. Sta. no. 826, 50 pp., 5 figs., 11 refs. Ithaca, N.Y., 1946.

This bulletin contains the results of investigations carried out in New York State in 1942–43 to obtain information regarding the prevalence and relative importance in lowering prices of the various defects found on apples for wholesale or retail sale as fresh fruit, and to determine to some extent the cause, place of occurrence and method of preventing the more important defects. Those considered include damage caused by the red bug [*Lygidea mendax*, Reut.], which is an important pest of apple throughout the State, the

codling moth [*Cydia pomonella*, L.] and minor insect pests. Of lots of otherwise comparable apples inspected at the Mid Hudson Fruit Auction, 39 per cent. were free from injury by *Cydia* and sold for an average price of 77 cents per bushel, while 43, 12 and 6 per cent. had few, several and many superficial injuries by the larvae and sold for averages of 72, 59 and 56 cents per bushel, respectively. Similarly, lots comparable for other qualities, including variability in diameter and deformity, but free from injury by *Lygidea* or having few, several or many shallow pits caused by its feeding punctures represented 60, 30, 7 and 3 per cent. of the total and sold for averages of 75, 69, 62 and 52 cents per bushel. It is estimated that these market losses are by themselves enough to justify spraying for the control of the two pests, though they take no account of the crop reductions they cause, since apples severely damaged by either do not mature or are discarded before they reach the market.

POST (R. L.). **Host and Distribution Notes on Wheat Stem Sawfly.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **8** no. 6 p. 23, 1 ref. Fargo, N. Dak., 1946.

A recent incomplete survey of the distribution of *Cephus cinctus*, Nort., on wheat in North Dakota [cf. *R.A.E.*, A **34** 146] indicated that it extended eastward to Nelson County. Examination of grass alongside roads adjacent to infested wheat fields showed that slender wheat grass [*Agropyrum pauciflorum*], brome [*Bromus*], western wheat grass [*A. smithii*] and quack grass [*A. repens*] were generally attacked.

MUNRO (J. A.) & POST (R. L.). **The European Corn Borer in North Dakota.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **8** no. 6 p. 29. Fargo, N. Dak., 1946.

It is reported that two larvae of *Pyrausta nubilalis*, Hb., which had not previously been recorded from North Dakota, were found in stems of sweet maize at Hillsboro in August 1945, and notes are given on its bionomics and control.

KURIR (A.). **Massenaufreten der Nonne (*Lymantria monacha* L.) in den östlichen Alpen (Steiermark).** [Outbreak of the Nun Moth (*L. monacha*) in the eastern Alps (Styria).]—*Allg. forst- u. holzw. Ztg* **57** no. 12 repr. [1] p. Vienna, 1946. **Waldstation für Nonnenforschung und -bekämpfung.** [Forest Centre for Research on the Nun Moth and its Control.]—*T.c.* no. 15–16 repr. [1] p. **Moderne Schädlingsbekämpfung in der Land- und Forstwirtschaft. DDT—Nervengift für Insekten.** [Modern Methods of Pest Control in Agriculture and Forestry. DDT, a Nerve Poison for Insects.]—*Op. cit.* **58** no. 3–4 repr. [3] pp., 10 refs. 1947. **Kartographisch dargestellte Massenvermehrungsgebiete der Nonne (*Lymantria monacha* L.) in Österreich von 1888 bis 1946.** [A Map showing the Outbreak Areas of *L. monacha* in Austria from 1888 to 1946.]—*T.c.* no. 9–10 repr. [2] pp., 1 map. **Zerstörungswerk der Nonnenraupen in den Gebirgswäldern der Nord-Steiermark.** [Destructive Activity of Nun Moth Larvae in the Mountain Forests of northern Styria.]—*Natur u. Tech.* 1947 pt. 4 repr. [4] pp., 2 figs., 1 map. Zurich, 1947.

In the first of these five papers on an outbreak of *Lymantria monacha*, L., that was first observed in 1946 in stands of spruce or spruce intermixed with larch or pine in the Austrian Alps, details are given of the extent and severity of the infestation, and the control measures that it was hoped to adopt in 1947 are briefly indicated. The outbreak, which had evidently been developing for several years, affected almost the whole valley of the Salza in northern Styria, comprising several thousand acres of forest, at altitudes higher than any at which the moth had previously been recorded. In late July 1946,

massive flights of adults were observed at 4,000–4,300 ft., and counts of eggs in September indicated that total defoliation would occur over a wide area in 1947. The principal control measure planned for 1947 was dusting the infested areas from an aeroplane at the onset of defoliation.

In the second paper, the author emphasises the desirability of establishing an observation centre such as those used in East Prussia [R.A.E., A 35 233] for investigations on the bionomics of the moth in Alpine regions, and in the third, he gives notes on the history and use against forest pests of DDT, which it was hoped to use against *L. monacha* in Austria in 1947.

The fourth paper contains a map showing the areas in Austria affected by *L. monacha* since 1888, with notes on the various outbreaks concerned, the most important of which were those of 1888–92, 1904–11, and 1946.

Much of the information in the fifth paper is the same as that given in the first, but it is further stated that other areas, including one in the Malta valley in Upper Carinthia, were affected in 1947. The bionomics of *L. monacha* and the injury it causes to coniferous and deciduous trees are reviewed, and it is stated that important control of the larvae was given in 1947 by polyhedral disease, particularly in the most severely infested stands in the Salza valley. The difficulties that prevented aeroplane dusting in 1947 are discussed.

KUENEN (D. J.). *Het winter ei van het fruitspint (Metatetranychus ulmi Koch en zijn bestrijding.* [The Winter Egg of the Fruit Tree Red Spider, *Paratetranychus pilosus*, C. & F., and its Control.]—*Tijdschr. Plziekt.* 52 pt. 3 pp. 69–82, 2 figs., 9 refs. Wageningen, 1946. (With a Summary in English.)

An account is given of experiments, carried out in Holland in 1942–44, on the development and control of the winter eggs of *Paratetranychus pilosus*, C. & F. (*Metatetranychus ulmi*, auct.) [cf. R.A.E., A 26 464–465], which occur on fruit trees from September until spring. The structure of the egg and the development of the embryo are described from microscopic examination. Embryonic development begins soon after the eggs are laid but ceases shortly afterwards with the onset of the diapause. It is resumed about the end of March, and the eggs hatch 3–4 weeks later. About 33 per cent. of the eggs die during the winter, and of those that survive, about 50 per cent. do not hatch, the reason for which is unknown. To test the effect of temperature on hatching, eggs on twigs were kept in the open in petri dishes, in which the relative humidity was maintained at 80 per cent., until selected dates from January to April, when they were transferred to the laboratory and exposed to a temperature of 15–16°C. [59–60.8°F.] until hatching was complete. Some eggs hatched following the earliest date of transfer, but the percentage increased as the date of exposure to warmth approached the date on which eggs kept at normal temperatures hatched (25th, 14th and 19th April in the three years, respectively). Since eggs transferred to the higher temperature shortly before the date of normal hatching showed a higher percentage hatch than those that hatched outside, it is concluded that fluctuations in temperature shortly before or during hatching have an injurious effect. In further tests, the optimum relative humidity for development after the diapause was found to be 75–80 per cent., although some eggs hatched at 100 per cent. and those kept at 0 per cent. for three months were not all killed.

In laboratory tests to determine in what manner the eggs are affected by petroleum oils, emulsions of which are known to give effective control, eggs sprayed with a proprietary winter oil diluted to contain 4 per cent. actual oil were dissected and examined microscopically at intervals throughout the winter. No difference was observed in the development of treated and untreated eggs until the mites were ready to hatch, when those in the treated eggs proved

unable to do so, apparently owing to a toughening action of the oil on the chorion of the egg. No traces of oil were found within the chorion of sprayed eggs.

In field experiments, the trunks and bases of the branches of a number of trees were sprayed so that all of known numbers of eggs received a covering of spray. The sprays used comprised a tar distillate (fruit-tree carbolineum), a winter oil, two preparations of dinitro-ortho-cresol and one containing both oil and dinitro-o-cresol, which is used as a combined spray against the eggs of Aphids and mites. The mites that hatched were removed and counted daily and the percentages of control with allowance for mortality of unsprayed eggs, are tabulated. The best control obtained was 98 per cent., given by the winter oil applied in mid-April 1942, but no other spray was applied so late in that year. In 1944, it did not give more than 86 per cent. control, even at high concentrations, and this variability is attributed to the fact that the oil does not penetrate the chorion. In both years, it was more effective when applied about mid-April than in March, probably because there was less time for it to evaporate between application and hatching. The tar distillate, which was not used after 1942, gave only about 50 per cent. control. The results from dinitro-o-cresol without oil were very variable; when diluted to 0.25 and 0.5 per cent., the preparation for which full results are given resulted in a lower mortality than occurred on unsprayed trees, but at concentrations of 2 and 4 per cent., it gave 55 and 64 per cent. control. The author concludes that, in practice, there is a danger that dinitro-o-cresol without oil will cause an increase in mite infestation. The preparation containing oil and dinitro-o-cresol usually gave better results than mineral oil alone applied on the same date, and was more effective in 1944 when applied in mid-April (90 per cent. control) than in January–March.

It is concluded that late spraying is more effective than early, but care should be taken not to delay spraying too long for fear of bud damage or, when the combined spray is used, of missing the Aphid eggs, which hatch about three weeks earlier than eggs of *P. pilosus*. Since the tests showed that even the most careful spraying does not eliminate all the winter eggs, there will always be some risk of attack by *P. pilosus* in summer.

VAN ROSSEM (G.). **Het voorkomen van den boonkever, *Acanthoscelides obtectus* Say (Col., Bruchidae) te Heerlen (L.).** [The Occurrence of *Bruchus obtectus* in Heerlen (Limburg).]—*Tijdschr. PlZiekt.* **52** pt. 3 pp. 85–89, 1 pl., 10 refs. Wageningen, 1946. (With a Summary in English.)

In the spring and summer of 1944, three samples of beans, two of which had been grown in Heerlen in the previous summer, were found to be infested by *Bruchus (Acanthoscelides) obtectus*, Say, which does not normally occur in Holland [cf. R.A.E., A 18 91] but is sometimes found in imported beans. In September 1945, when bean fields north of Heerlen were examined, nine adults were collected; when placed in a jar with beans, they laid eggs that hatched a week later, and the larvae entered the beans. This was the first known instance of the occurrence of this Bruchid in the field in Holland, and the literature on its bionomics was studied to assess the possibility of its becoming established. Meteorological records at Maastricht showed that the average monthly temperatures were at least 19°C. [66.2°F.] in July and August, and since it is stated in a work by Zacher [26 468] that adults can develop at a temperature as low as 18–20°C. [64.4–68°F.], it is possible for a field generation to occur in Holland, particularly on southern slopes and in fields, such as those to the north of Heerlen, where temperatures are higher than the average. The Bruchid cannot overwinter in the open, however, so that field infestation can originate only from stored beans.

KEARNS (H. G. H.). **Hydraulic Spraying Machinery for Fruit Crops. The Choice of Power Equipment.**—*Rep. agric. hort. Res. Sta. Bristol 1945* pp. 110–132. Bath [1946].

The following is the author's summary. Power-operated hydraulic spraying machinery for fruit crops is classified. The biological requirements of spraying are described. Guidance is given for the choice of spraying machinery. Broad specifications for the principal components of hydraulic equipment are given.

KEARNS (H. G. H.), MARSH (R. W.) & MARTIN (H[ubert]). **Experimental spraying Programmes on Apples at Long Ashton: Season 1945.**—*Rep. agric. hort. Res. Sta. Bristol 1945* pp. 132–140, 1 fig., 1 ref. Bath [1946].

The results are given of experiments carried out in Somerset in 1945 to observe the effect of DDT on populations of apple pests, particularly *Anuraphis roseus*, Bak. (*Yezabura malifoliae*, auct.) and *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.). Late March and April were exceptionally warm and dry, so that the flower buds opened about three weeks earlier than usual, and a severe frost on the last night of April destroyed the crop with the exception of small distorted fruitlets on the trees suffering from severe attack by Aphids. The rest of the summer was generally cool and sunless, but deficient in rainfall. The tests were made on three acres of Worcester Pearmain, Lane's Prince Albert and Laxton's Superb apples that had not received a winter spray against Aphids and mites.

DDT (81 per cent. p,p'-isomer) was used in three forms. In the first, in which it was applied at the bud-burst, early pink and fruitlet stages (24th March, 11th–13th April and 18th–19th May, respectively), or at the last two of these, 1 lb. DDT and 4 oz. coumarone resin of low softening point were dissolved in 1 gal. warm summer oil (or, for the application at bud-burst to a few trees, winter oil), and the cold solution emulsified with 0.5 gal. 7.5 per cent. sulphite lye and diluted to make 100 gals. spray. In the second, in which it was desired to test a solvent non-miscible with water but sufficiently volatile to ensure evaporation when the spray dried, thus leaving a solid deposit of DDT on the foliage, 1 lb. DDT and 4 oz. anhydrous cyclohexylamine dodecyl sulphate (an emulsifier marketed under the name Product MB 320) were dissolved in 2.5 pints benzene and the solution made up to 100 gals. with water. This spray was used in the early pink application. In the third, in which the solvent was miscible with water so that the DDT formed a suspension, 1 lb. DDT was dissolved in a mixture of 3.5 lb. acetone and 5 lb. carbitol (diethylene glycol monoethyl ether) containing 8 oz. Sulphonated Lorol TA (50 per cent. aqueous solution of triethanolamine dodecyl sulphate), and made up to 100 gals. This was used in the fruitlet application on the trees that had received the second formula at the early pink stage. Since a fungicide that could be used with oil was required for use against scab [*Venturia inaequalis*], 2 lb. ferric dimethyldithiocarbamate or tetramethylthiuramdisulphide or 4 lb. copper sebacate was added per 100 gals. spray in the early-pink and fruitlet applications and was also applied with 1 gal. oil but without DDT at midsummer. The methods of preparing the fungicides for use are described. The controls received four applications of a lime-sulphur spray.

Most of the Aphids hatched on 20th–22nd March, and infestation developed normally on the controls, whereas it was arrested in its early stages by DDT. The percentages of the flower trusses infested on 1st June on the two varieties on which counts were made were 29.2 and 51.2 on the control trees and 1.4–4.6 and 2.4–8.4 on those sprayed with DDT. Three applications of the emulsion gave the best results, and two were more effective than two of DDT without oil. The application at the pink stage apparently had the greatest effect. The

results against *Paratetranychus* were inconclusive, since spray damage caused considerable defoliation on some of the trees, but infestation was highest on trees sprayed with DDT without oil, lowest on those sprayed with oil and moderate on the controls. The application of oil at the fruitlet stage caused leaf damage that was appreciable on all varieties and especially severe on Lane's Prince Albert; this phytocidal effect may have been enhanced by the low state of vigour of the sprayed trees. Copper sebacate was about equal to lime-sulphur as a fungicide, but may be damaging to apple varieties sensitive to copper. The other two fungicides were compatible with oil, but less effective than lime-sulphur in scab control.

BENNETT (S. H.). **Some Observations on the Flight Period of the Codling Moth (*Laspeyresia (Cydia) pomonella*) in Worcestershire during 1944 and 1945.**—*Rep. agric. hort. Res. Sta. Bristol* 1945 pp. 140–143, 2 graphs, 1 ref. Bath [1946].

From the results of catches of adults of *Cydia (Laspeyresia) pomonella*, L., in trays containing a bait of beet molasses in water (1 : 9) fermented with 3½ gm. baker's yeast per litre, which were suspended in apple trees in an orchard in the western midlands of England in 1944 and 1945, it is concluded that although eggs may be deposited from late May until August, the maximum hatching period occurred during the first two weeks of July. The degree of control obtained with lead-arsenate sprays is likely to vary in different seasons, a single application being more effective when the peak flight period is concentrated into a fortnight, as in 1945, than when flight is considerable over a period of five weeks, as in 1944. The spray should be applied as near as possible to the time of maximum hatching of the larvae, and in a season when the flight period is short, the optimum results are generally obtained under local conditions by an application at the end of June. When the flight period is prolonged, as it is after cold weather in early June, it may be necessary to make two applications, and in this case maximum control will probably be obtained by spraying at the end of the third week in June and about a fortnight later.

HADDOCK (M. J.). **Observations on the Species of Flea Beetles infesting Brassica Crops in the West of England.**—*Rep. agric. hort. Res. Sta. Bristol* 1945 pp. 166–169, 2 refs. Bath [1946].

The following is largely the author's summary of observations in five counties in the west of England. The "turnip fly" or "turnip flea-beetle" is not a single species but a complex of species, and often five and sometimes eight may be involved in attacks on cruciferous crops. Of more than 3,000 specimens examined in 1944 and 1945, 98 per cent. belonged to the genus *Phyllotreta* and the remainder consisted of *Chaetocnema concinna*, Marsh., a few examples of *Longitarsus* spp., and a single example of the genus *Aphthona*. *P. atra*, Payk., *P. diademata*, Foudr., and *P. undulata*, Kutsch., were the commonest species in these years, but *P. nemorum*, L., and *P. cruciferae*, Goeze, were plentiful locally. The seedlings may be infested at any time from April to July, and throughout this period the common species are likely to be the most numerous species of flea-beetle on seed beds and in young crops. They show little preference for any particular crop and appear to infest kale, cabbage and other cruciferous farm crops with equal readiness. Among market-garden crops, radish and kohlrabi were found to be infested by a range of species [cf. *R.A.E.*, A 16 615–616].

EGO-AGUIRRE (A.). **Las langostas de Jaén. Informe del viaje efectuado a la zona infestada por la langosta.** [The Locusts of Jaén. Report on a Journey through the Zone infested by *Schistocerca paranensis*.]—*Inf. Estac. exp. agric. La Molina* no. 61, 25 pp., 16 figs., 1 map. Lima, 1946.

An outbreak of *Schistocerca paranensis*, Burm., began in the region of Jaén, northern Peru, in August 1944, when swarms crossed the frontier from Ecuador, and a survey in March 1946 showed that nearly 3,900 sq. miles were infested, with considerable damage to crops. The infested area is shown on a map and lists are given of the plants attacked, with notes on the injury caused. The region is warm and dry, with strong winds that favour swarm migration, and there was thought to be no danger of the locusts spreading to other regions, where conditions are less favourable for development and humidity too high for the persistence of phase *gregaria*.

Flame-throwers were tested in the course of the survey, but proved to be of doubtful value, as many of the larger hoppers escaped unless measures were taken to concentrate the band. A dust of gypsum and benzene hexachloride at a concentration to give 0.1 per cent. γ isomer killed all fourth- and fifth-instar hoppers and young and old adults in 13 hours when applied to them in a cage and in 36 hours when applied to a cage into which they were subsequently introduced; when the dusted cage was hung in the wind, 90 per cent. of the locusts died in 34 hours and the rest were moribund. Hoppers and adults in a band about 440 yds. wide were all dead 24 hours after being dusted in the field. Good results were obtained by dusting crops, although it was difficult to ensure that all the locusts were reached by the dust, and it is thought that preventive treatment would safeguard crops in fine weather; suitable programmes of combined measures are suggested. An emulsion of 3 per cent. soap and 5 per cent. kerosene was ineffective when sprayed over a band of hoppers; higher concentrations of kerosene were not tested for fear of damaging crops.

Pupae of *Sarcophaga (Acridiophaga) caridei*, Brèth., an important parasite of *Schistocerca paranensis* in Argentina [cf. R.A.E., A 33 401, etc.] were obtained from that country and kept in a refrigerator until March 1946. Adults emerged a few days after the pupae were restored to normal temperature and fed on sugar and water. When some of the females had been fertilised, they were released over a large band of hoppers. Laboratory breeding was to be continued, and it was hoped to make further releases.

WILLE (J. E.). **Experimentos con los nuevos insecticidas DDT y Gammexane ejecutados en la Estación Experimental Agrícola de La Molina hasta fines de Mayo de 1946.** [Experiments with the new Insecticides DDT and Gammexane carried out at the Agricultural Experiment Station of La Molina up to the End of May, 1946.]—*Bol. Estac. exp. agric. La Molina* no. 29, 33 pp., 3 figs., 8 graphs, 8 refs. Lima, 1946.

A detailed account is given of field and laboratory experiments carried out in Peru during the summer of 1945-46 to test the effectiveness of DDT and Gammexane Dust D.034, which contains 4 per cent. benzene hexachloride, corresponding to 0.4 per cent. γ isomer, against various common pests of plants and stored grain. For use against the former, the benzene-hexachloride dust was diluted, with gypsum unless otherwise stated, to contain 0.1 per cent. γ isomer. A 3 per cent. DDT dust applied once to cabbages infested by Pierid larvae, chiefly *Ascia (Pieris) monuste*, L., gave complete mortality, as compared with 11 per cent. for two applications at an interval of six days of a spray of 1 lb. lead arsenate and 1 lb. lime in 10 gals. water. It did not injure the plants and remained effective for 15-20 days. A spray of Gesarol AK 40 [40 per cent. DDT], diluted to contain 0.1 per cent. DDT and applied to tomatoes six times between January and March, gave complete control of *Gnorimoschema (Phthorimaea) sp.*, *Empoasca fabae*, Harr., *Epitrix* spp. and *Diabrotica* spp. on

the leaves and stems and reduced the percentage of fruits damaged by *Conotrachelus* sp. and Noctuid larvae, including *Laphyrgma frugiperda*, S. & A., to 6.2 and 1.45, respectively: this result was much better than that given in another district by a lead-arsenate spray. A spray containing 0.2 per cent. DDT as an emulsified solution was ineffective against *Selenaspis articulatus*, Morg., and *Lepidosaphes beckii*, Newm., on *Citrus*.

A spray of Gesarol A 20 [20 per cent. DDT with wetting agent] diluted to contain 0.05 per cent. DDT and the benzene-hexachloride dust, applied 4-5 times at intervals of 11-15 days to melons and watermelons against *Diaphania* spp., both gave fair control, particularly on melons, on which the percentages of shoots and fruits infested averaged 17.8 and 32.1, respectively, for DDT and 20 and 45 for benzene hexachloride, as compared with 59.4 and 74.6 in the controls. The dust caused appreciable scorching when heavily applied, but the spray caused very little and appeared to encourage plant growth. Five applications at intervals of about 10 days of Gesarol A 3 dust, which contains 3 per cent. DDT, gave good control of adults and nymphs of *Empoasca* spp. on soy beans, but were ineffective against larvae of *Cydia* (*Laspeyresia*) *leguminis*, Heinr., and *Elasmopalpus lignosellus*, Zell. In a subsequent test, when infestation by *Cydia* had subsided, the benzene-hexachloride dust gave complete control of *Elasmopalpus* in a week. In experiments in cotton fields, four fortnightly applications of Gesarol A 5 dust (5 per cent. DDT) and the benzene-hexachloride dust were rather ineffective against larvae of *Anomis texana*, Ril., and *Mescinia peruella*, Schaus, adults and larvae of *Anthonomus vestitus*, Boh., and various stages of *Aphis gossypii*, Glov., but were harmless to predacious Coccinellids and *Chrysopa* sp. DDT was useless against *Dysdercus ruficollis*, L., in the laboratory, but the benzene-hexachloride dust proved very effective and remained so for at least ten days. In a field test, it reduced the population considerably and was slightly more effective than a sabadilla dust, but reinfestation occurred within two days.

In tests against *Anastrepha* sp., two trees of *Annona cherimolia* were each enclosed in a tent with a floor of strong paper, in which it was found that the fruit-flies survived for about as long as in the open. One tree was sprayed with Gesarol A 20 diluted to contain 0.5 per cent. DDT, and the other dusted with the benzene-hexachloride dust in talc. Laboratory-reared flies were then released in them at intervals. Benzene hexachloride was very toxic on the first day, but ineffective after three days, and appeared to have a repellent action. DDT was very effective, 60-70 per cent. of the flies released in the tent for up to 20 days after the application dying within a day, and its toxicity was still evident 50 days after application.

DDT dust (Gesarol A 5) proved ineffective against adults and hoppers of *Schistocerca paranensis*, Burm., either in cages or in the open, but good results were obtained with benzene hexachloride in work already noticed [see preceding abstract] and here recapitulated.

In a small-scale laboratory experiment, Geigy 33, here stated to contain 33 per cent. DDT [cf. R.A.E., A 36 38], at 1:1,000 and Gammexane Dust D. 034 at a rate to give 1:1,000,000 parts γ isomer were mixed with wheat heavily infested with *Calandra oryzae*, L. The percentages of weevils dead after 15 days were only 89.48 and 69.52, respectively, as compared with 49.16 for no treatment, and all the samples of grain had been completely destroyed 4½ months after treatment.

MANALO (G. D.), HUTSON (R.) & BENNE (E. J.). DDT Residues on Fruits and Vegetables.—*Quart. Bull. Mich. agric. Exp. Sta.* **28** no. 4 pp. 272-280, 15 refs. East Lansing, Mich., 1946.

In preliminary tests to determine the amount of DDT remaining on fruits and vegetables that had been sprayed or dusted with it, weighed samples of

crops that had been treated under field conditions in Michigan, at average intervals of two weeks, and harvested in the normal manner, but at varying stages of maturity, were extracted with benzene, and the extracts were analysed for DDT. The residues on the samples and the treatments received by the plants from which they were obtained are shown in tables. Of two samples of blueberries, four of grapes, seven of peaches and 36 of apples, only one sample of grapes, which had received four sprays, the last applied three weeks before the sample was taken, had more residue (7.12 mg. per kg. fruit) than the tolerance (7 mg. [cf. *R.A.E.*, A 35 110]). Two samples of apples that were tested to determine whether DDT had drifted on to them when adjoining plots were treated contained practically no DDT.

Of the vegetables tested, green bean pods contained little DDT, but the leaves from the same plants contained as much as 206 mg. per kg., and it would be dangerous to use them as roughage for livestock. The same applies to the small heads and outer mature leaves of cabbage, which had 5.96 and 21.13 mg. per kg. The mature stalks and leaves of celery, mature turnip tops and young turnip tops had 13.16, 14.47 and 17.34 mg. per kg., respectively, when gathered three days after one application of a DDT dust, but only 1.62, 4.79 and 5.83 mg. when gathered 22 days after the application.

The results obtained show that DDT sprays and dusts left varying amounts of residue that did not bear any direct quantitative relationship to the number of applications and that did not decrease proportionately with the period between the last application and harvest, and it is concluded that analysis for the amount of DDT in a food is the only safe guide for determining whether it is fit for consumption and that the insecticide should not be used on the parts of vegetables used for food without great caution.

MANALO (G. D.), HUTSON (R.), MILLER (E. J.) & BENNE (E. J.). **Removal of DDT Spray Residues from Apples.**—*Quart. Bull. Mich. agric. Exp. Sta.* 29 no. 1 pp. 15-22, 1 fig., 9 refs. East Lansing, Mich., 1946.

In experiments to find methods of removing residues of DDT sprays from apples, Grimes Golden apples that had been in cold storage for several months were coated by spraying them with a suspension of 8 gm. wettable powder (50 per cent. DDT) in 4 litres water until they were uniformly wet and allowing them to dry at room temperature. The process was repeated three or four times to constitute one coating, and two or four coatings were applied to some of the apples at intervals of about five days, during which time they were stored at about 3°C. [37.4°F.]. For each test, a sample of five or six apples treated to remove the DDT and an untreated sample were analysed for residue. Of the treatments investigated, only peeling removed practically all the DDT, none of which could be detected on the flesh of apples that had previously been polished and only a trace on that of apples that had not been polished. Polishing with a dry cloth reduced the DDT residue from 11.64-42.28 to 7.71-31.2 mg. per kg. fruit, according to the number of spray coats applied, and brushing with a dry brush, washing with tap water and washing with a 0.5 per cent. solution of Dreft [sodium lauryl sulphate] reduced it from 45.75 mg. to 29.17, 28.64 and 28.13 mg., respectively. When apples bearing various amounts of DDT were mechanically brushed during the washing process, the approximate percentages of DDT removed were 12-32 by 1 per cent. hydrochloric acid, 15-38 at 22°C. [71.6°F.] and 19-42 at 36-42°C. [96.8 and 107.6°F.] by 0.25-0.5 per cent. Dreft, 20-42 at 22°C. and 12-40 at 37°C. [98.6°F.] by 1 per cent. Naphtha soap, 14 by 0.5 per cent. ethyl acetate, 13 by 0.1 per cent. benzene emulsified with Dreft, 11 by 0.5 per cent. ethyl alcohol and 10 by 1 per cent. acetone; higher concentrations of the last four could not be used without injuring the fruit.

The results obtained were erratic, even with the same washing agents, and neither concentration nor temperature exerted a consistent effect on the amount of insecticide removed, but if large amounts of DDT were present, no treatment but peeling reduced them below the tolerance of 7 mg. per kg. fruit. Since solutions of detergents, organic solvents and hydrochloric acid did not consistently remove more DDT than tap water alone, it appears that such DDT as was removed was largely dislodged mechanically. The average quantity of DDT removed by all treatments except peeling was 26.2 per cent., and with a treatment of this efficiency the maximum amount of residue that could be reduced to the tolerance limit would be 9.47 mg. per kg. fruit. It appears, therefore, that the best way to reduce DDT residues on apples is to limit the number of applications.

BOYD (W. M.). **Injurious Insects of New Jersey Nurseries.**—*Circ. N. J. Dep. Agric.* no. 355, 142 pp., illus., many refs. Trenton, N.J., 1945.

Notes are given on the appearance, bionomics and control of 88 insects and a mite (*Tetranychus telarius*, L.) that attack trees and shrubs in nurseries in New Jersey, with references to the more important literature on each of them. The control of leaf-feeding, sucking and boring insects in general is discussed in the introduction.

PARKS (T. H.). **Hessian Fly and other Insect Pests in the 1946 Wheat Crop.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* 31 no. 242 pp. 117-119, 1 map. Wooster, Ohio, 1946.

A survey carried out in Ohio just before the harvest of 1946 showed that infestation of wheat by the Hessian fly [*Mayetiola destructor*, Say], which had been increasing since 1944 [cf. *R.A.E.*, A 35 84], averaged 12 per cent., but was still below the average for the years 1918-46. The increase is attributed largely to the wet weather in May, which favoured the survival of larvae and their establishment on the stems. The average infestation was above 30 per cent. in two south-central counties and over 15 per cent. in a few others, although few of the straws were lodged at harvest and the loss in yield was slight. Infestation was lightest in the northern third of the State, and the general situation is regarded as satisfactory except in some south-central and west-central districts in which early sowing of wheat may cause an increase in fly populations. The safe sowing dates for the State are shown on a map, and it is pointed out that while wheat sown on or soon after these dates rarely becomes seriously infested, an excessive delay in sowing involves the risk of poor plant establishment.

In isolated fields, a few Cercopids [*Philaenus leucophthalmus*, L.] attacked wheat heads, to which they migrated from neighbouring hayfields during cool wet weather in May and early June [cf. *loc. cit.*], but no serious damage was caused; in some localities, however, they were very injurious to young maize, on which they settled after fields of clover had been cut for hay. Other common insect pests of wheat were not important.

SHAW (F. R.). **Some Observations on the Effect of a 5 per cent. DDT Dust on Bees.**—*Canad. Ent.* 78 no. 5 p. 110. Guelph, Ont., 1946.

In two small-scale laboratory tests in Massachusetts, a dust containing 5 per cent. DDT was lightly applied through the screen top of a cage to 20 solitary bees, 15 bumble bees and, in one test, 10 honey bees, all of which had been collected from apple blossom; sugar syrup (1 : 1) was provided after dusting. Mortality of bumble bees was complete in 36 and 60 hours and of solitary bees and honey bees in 24 hours, and definite symptoms of lack of co-ordination were observed in several instances within 10-15 minutes of the application of the dust. Although too few bees were tested for definite conclusions, it is thought that solitary and honey bees exposed to DDT dusts as they pollinate agricultural crops are liable to be poisoned.

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